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MOBILITY AND TRANSPORT CONNECTIVITY SERIES

RAILWAYS IN DEVELOPING COUNTRIES: A GLOBAL REVIEW

WORLD BANK GROUP

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Contents

Figures

Maps

Tables

Acknowledgments

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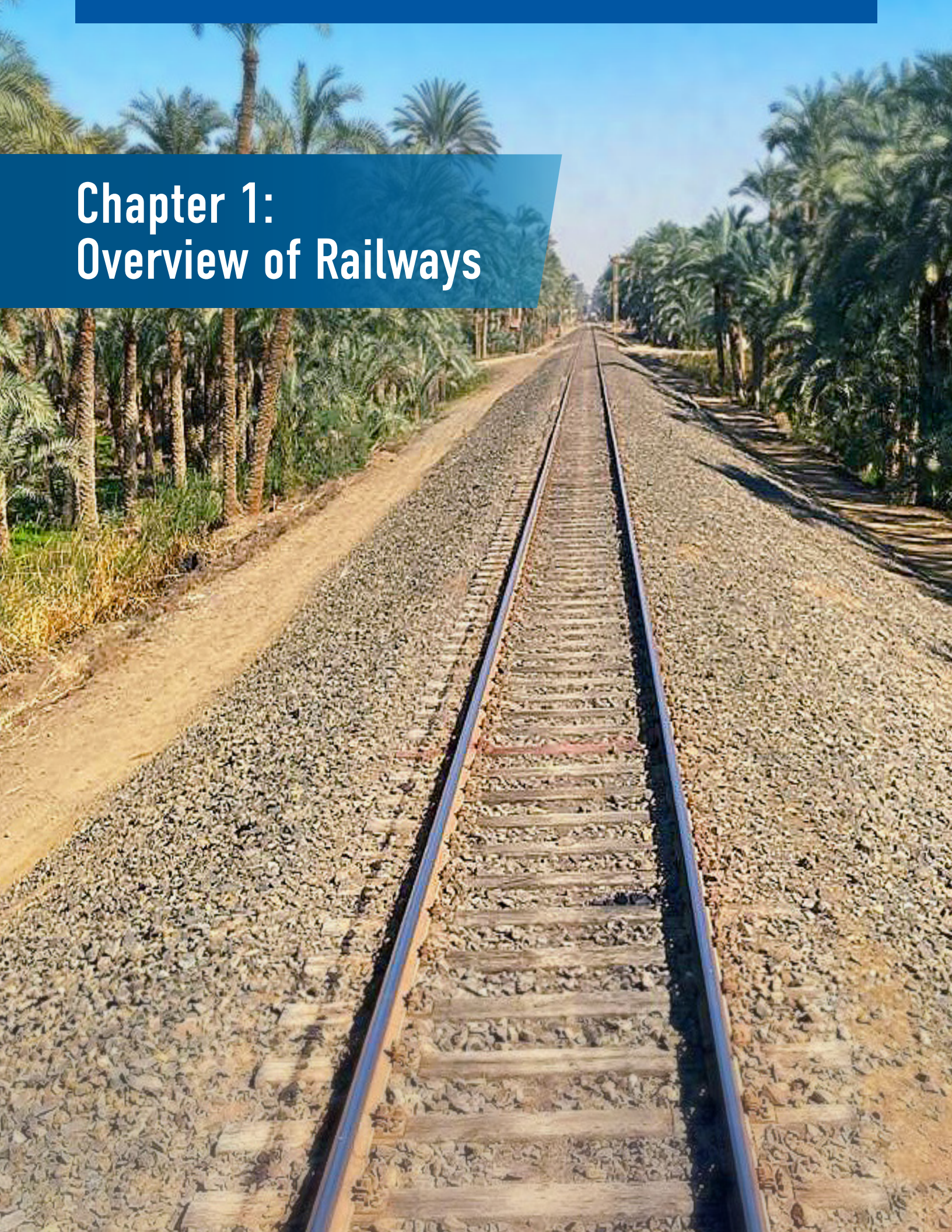
Abbreviations and Acronyms

CIS	Commonwealth of Independent States
DRT	Department of Rail Transport (Thailand)
ENR	Egyptian Railway
GCC	Gulf Cooperation Council
GHG	greenhouse gas
IBRD	The International Bank for Reconstruction and Development
ME	Middle East
NPV	net present value
NTKM	net ton-kilometer (metric)
OECD	Organisation for Economic Co-operation and Development
ONCF	Moroccan Railway
OSJD	The Organisation for Cooperation of Railways
PKM	passenger-kilometer
PMR	product market regulation
PPP	purchasing power parity
SA	South Asia
SEA	Southeast Asia
SNCFT	Tunisian Railway
SRT	State Railways of Thailand
SSA	Sub-Saharan Africa
TAZARA	Tanzania–Zambia Railway
TEU	twenty-foot equivalent unit
VNR	Vietnam Railways
VRA	Vietnam Rail Authority
WEF	World Economic Forum



Chapter 1: Overview of Railways

Introduction

As a green mode of transportation, railways have an important role to play in decarbonizing transport through shifting transport from more polluting modes of transport such as road and air. Railways can enable economic growth, which in turn generates increasing transport demand, while keeping greenhouse gas (GHG) emissions low. However, in many parts of the world, railways have lost traffic and market share to air and road transport modes. As countries seek to reduce their GHG emissions, while still delivering on economic growth, many are rethinking the role of rail.

Many developing countries have existing railway networks, which will provide the starting point for efforts to increase rail in the transport mix. This report provides a basic stocktaking of those railways, explaining the industry structure and the current situation. Basic data on network size; volume; passenger fares and freight tariffs; labor productivity; network density; and perceived service quality assets, traffic, pricing and staffing have been compiled into the Developing Country Rail Database, which could be useful for analysis and comparisons across regions. The data have been collected from various public sources—annual railway or regulator reports and/or national statistical annuals. Most data are for 2018.

The report covers railways providing services to the general public in 77 countries. Not included are the railways in most higher income countries (North America, Europe, Australasia, and northeast Asia), private mining railways and China, whose railway network has been covered in numerous other reports (Lawrence, Bullock, and Liu 2019). The information shared in this report is presented in seven regional summaries, which group together railways sharing a common geographic area and other characteristics: Latin America; Sub-Saharan Africa; North Africa; South Asia; Southeast Asia; the Commonwealth of Independent States (CIS) and Mongolia; and the Middle East, Caucasus and Turkey. These summaries include basic data on institutional arrangements.

Institutional Models

One hundred years ago, rail (and inland waterways in some areas) held a near monopoly on long- and medium-distance land-based transport for both passengers and freight. As transportation became more motorized, the dominance of rail began to erode. After World War II, this decline accelerated in many countries as investment in roads and domestic aviation services increased. Despite changing market conditions, rail institutional structures and management models remained relatively unchanged. As a result, was that the finances of many railways became increasingly fragile, and railways became increasingly dependent on governments—at first for investment funds and then for operating support as well. In some countries, this deterioration proved fatal. In others, railways survived but were little better than walking wounded. Eventually this led to fundamental changes in how governments managed railways, with a wide range of solutions adopted to improve the situation.

As can be seen in the regional chapters, these methods varied between regions and countries. In much of Latin America, many of the earliest railways were built as concessions. As the rail concessions expired, state railways took over operations; however, these were subsequently often converted again to concessions (and in one country reconverted a second time back to state ownership). In Africa, most of the railways were built by colonial powers to link internal regions with ports. The departure of the colonialists saw most of these railways become government railways, which, in many cases, soon languished. Furthermore, as road competition grew, operating subsidies were reduced—causing maintenance to be chronically deferred—and investment funds dried up. This led to a number of railways ceasing operations, while some others were concessioned under a range of conditions. In both Latin America and Africa, long-distance passenger services have almost disappeared in the face of bus competition. A more detailed discussion of the concessions is given in separate regional reports.

In the CIS, long-distance road transport was limited until after 1990, and railways carried large volumes of traffic. Though rail traffic fell sharply after 1990, it has since recovered in most countries. Because of the large distances and volume of bulk traffic, many of the railways have continued to operate successfully. While some rail networks have continued to thrive while operating widespread passenger services, some smaller ones needed to make significant adjustments to ensure a sustainable future.

Most railways in Southeast Asia, except for Thailand, were built by colonial governments and remained as government railways following independence. Currently, they all now require some form of financial support, both to continue to operate substantial passenger services as well as contribute to infrastructure maintenance.

Three of the four railways covered for South Asia comprised parts of the same system until Indian independence in 1947. Since then, they have all continued as, effectively, government departments under the control of a Ministry of Railways. Although Indian Railways has been financially self-supporting (except for some investment), those in Pakistan, Bangladesh, and Sri Lanka require substantial government support.

Further details on the arrangements in each region are provided in the chapters for each region.

Current Situation

Networks

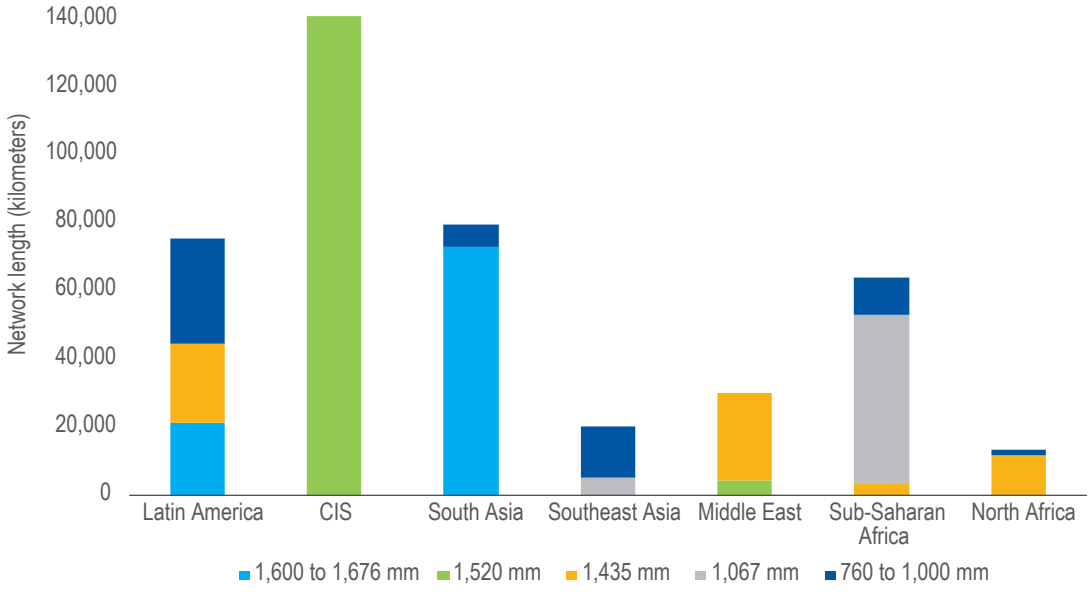
The 77 railways covered in this report accounted for, at the end of 2019, a total of 424,009 route-kilometers,[1] more than the total rail networks of North America, or of Russia and China combined (figure 1.1).

Although standard gauge (1,435 millimeters or 4 feet, 8.5 inches) represents the dominant gauge in Europe, North America, and China, this is far from the case elsewhere. The largest networks are 1,520 millimeters (5 feet) with 141,353 route-kilometers in the CIS, 1,676 millimeters (or 5 feet, 6 inches), principally in India, Argentina, and Brazil, followed by meter gauge (1,000 millimeters) in Latin America, Southeast Asia, and Africa. Much of Africa, and especially the extensive Southern Africa network, uses the eponymous Cape gauge (1,067 millimeters or 3 feet, 6 inches) or meter gauge. Standard gauge is found in Mexico, the Middle East, and some new, recently constructed lines in Africa.

Most of these networks are single-track railways, except for busier sections in suburban areas or in sections with heavy passenger and freight volumes (principally India, Ukraine, and Kazakhstan). About 29 percent of the networks are electrified, but this varies from more than 43 percent in South Asia and the CIS and 27 percent in the Middle East, to under 5 percent in Latin America and Southeast Asia. This partly reflects the density of traffic carried (because the economics of electrification improve as volume increases) and partly the cost of diesel in the countries concerned.

Network standards and infrastructure conditions vary substantially from country to country. In general, the greater the traffic volumes, the higher the standards and the better the condition. Many low-volume railways (with densities of 1 million net tons or less) have long sections of track that require repair or replacement. Others have nonoperational sections that will require rehabilitation before any operations can recommence. Even where services are operated,

Figure 1.1. Railway Networks by Region and Gauge



Source: See appendix A for country-level raw data and appendix B for country-level source information.
Note: mm = millimeter; CIS = Commonwealth of Independent States.

poor track conditions force speed restrictions, resulting in a loss of railway competitiveness and rollingstock productivity. Signaling similarly ranges from modern automatic signaling on high-volume networks to manual systems adequate in terms of capacity, but vulnerable from a safety viewpoint. Communications show similar variations.

Many low-volume, general-purpose railways are confronting major challenges associated with aging infrastructure, for which the cost of rehabilitation is large compared to the existing traffic volumes and revenues. How to rehabilitate the lines on a sustainable basis is the key issue faced by many such railways.

Traffic

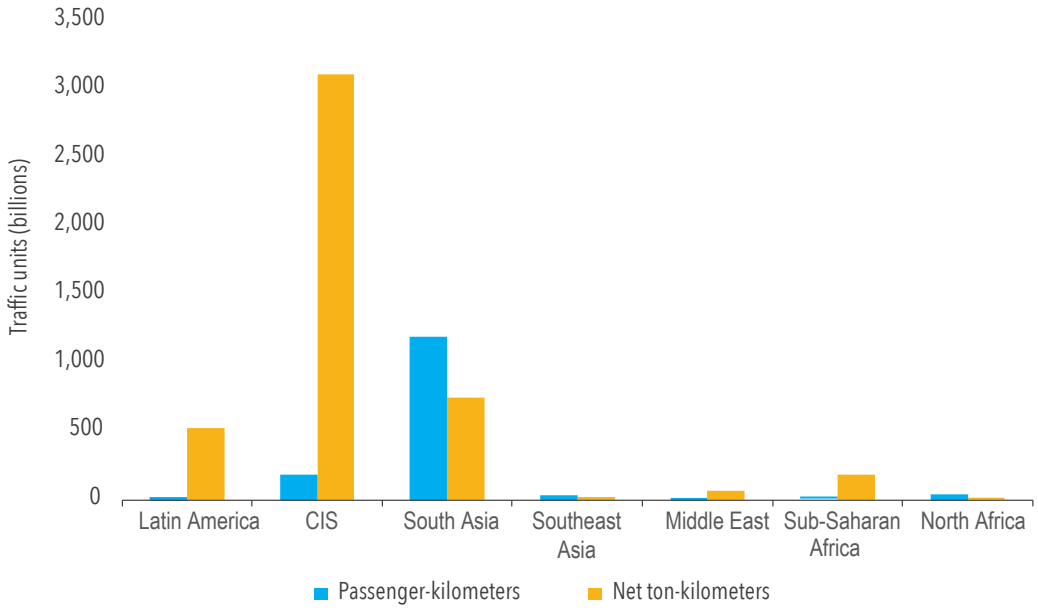
In total, these railways carried 4.9 billion tons (4.7 trillion net ton-kilometers) of freight and 13 billion passengers (1.5 trillion passenger-kilometers) in their last reported year. These railways range in traffic from the small West African railways carrying a few hundred thousand tons and almost no passengers, to India, with 1.2 billion tons and more than 8 billion passengers in 2018 (figure 1.2).

By far the greatest passenger demand of the countries studied (in terms of passenger-kilometers) is in South Asia, and specifically in India, which represents 95 percent of the regional total. The only significant passenger services in Latin America are suburban services in Argentina, Brazil and Chile. CIS passenger traffic is mostly in Ukraine, with Southeast Asian passenger traffic primarily in Indonesia. Middle East passengers are primarily in Iran, and African passengers are predominantly on the South African suburban networks.

Freight traffic is more evenly distributed, but Russia and India remain the countries with the largest task in terms of net ton-kilometers. Freight in Latin America is dominated by Brazil, which carries about 80 percent of the total, 60 percent of which is export iron-ore traffic. Mexico carries much of the remaining freight. CIS freight is largely in Russia, Kazakhstan, Ukraine and Belarus. in Africa, South Africa's network is by far the most heavily used, with its specialist coal and ore export routes.

Most national railways are relatively small, with only 20 railways out of the 74 reviewed carrying more than 10 million traffic units per year. Russia and India

Figure 1.2. Railway Traffic Units by Regions



Source: See appendix A for country-level raw data and appendix B for country-level source information.
Note: CIS = Commonwealth of Independent States.

carry this volume of traffic every two days, and other large railways such as those of Brazil, Ukraine and Kazakhstan handle this every one to two weeks.

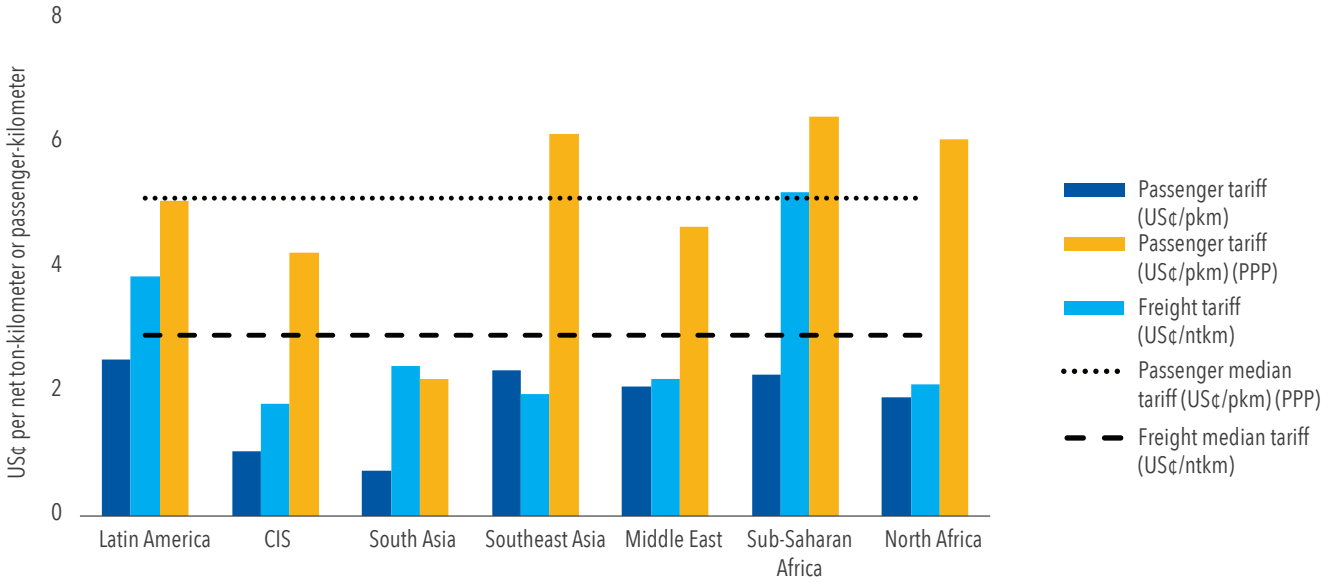
Most railways carry passenger traffic to some extent; however, in many countries the nonurban passenger business has declined and several of the smaller railways that retain a reasonable passenger business only do so because competing road networks either do not exist or are in very poor condition. While international services survive in networks such as those of the CIS, they face strong competition from budget airlines. In Africa, the only significant cross-border passenger flows operate on the Sitarail, Transrail, and Tanzania-Zambia Railway Authority (TAZARA) networks.

Most railways outside South Asia and Southeast Asia carry far more freight than passengers. Although many railways are dominated by bulk and semi-bulk commodities, service level is an important consideration for many shippers. Only a limited number of railways have successfully managed to be competitive in service, and this is increasingly becoming a key factor in their long-term survival.

Pricing

Almost all passenger services face strong competition from buses and shared taxis in both price and service frequency. Few corridors remain in which rail passenger services are the only effective means of transport, and although some main lines have been upgraded—with modern rollingstock providing faster services—this is far from the norm. Bus fares are typically 30 percent to 50 percent higher than the economy rail fares (which range from US$0.01 to US$0.03 per passenger-kilometer) (figure 1.3). But on many routes, buses are faster (sometimes twice as fast), with generally a much higher service frequency. Although rail is generally perceived as safer and, on some routes, allows the carriage of large quantities of produce and baggage, buses typically have the lion's share of the market. On a purchasing power parity (PPP) basis, the median tariff is US$0.051 per passenger-kilometer, rather lower than typical European prices; however, all such comparisons need to be done with care, because of the variations in the level of service offered, both within countries and between countries.

Figure 1.3. Median Railway Passenger and Freight Rates by Region



Source: See appendix A for country-level raw data and appendix B for country-level source information.
Note: ntkm = net ton-kilometer; pkm = passenger-km; PPP = purchasing power parity; US¢ = US cent (1/100 of US$1).

Average freight tariffs range from US$0.01 to US$0.05 per net ton-kilometer, similar to tariffs on other general-freight railways in comparable countries. Tariffs are generally constrained by competition, either from road transport or in some cases from alternative rail routes. Tariffs are also influenced by the traditional value-based tariff structures, length of haul, the relative cost of carrying different commodities (as reflected in net tons per wagon roundtrip), direction of travel and volume. However, in spite of most rail rates being well below comparable road rates, especially for traffic such as containers, rail typically only carries 20 to 50 percent of the nonbulk traffic in a corridor, and some of the smaller state-owned railways have a much smaller share.

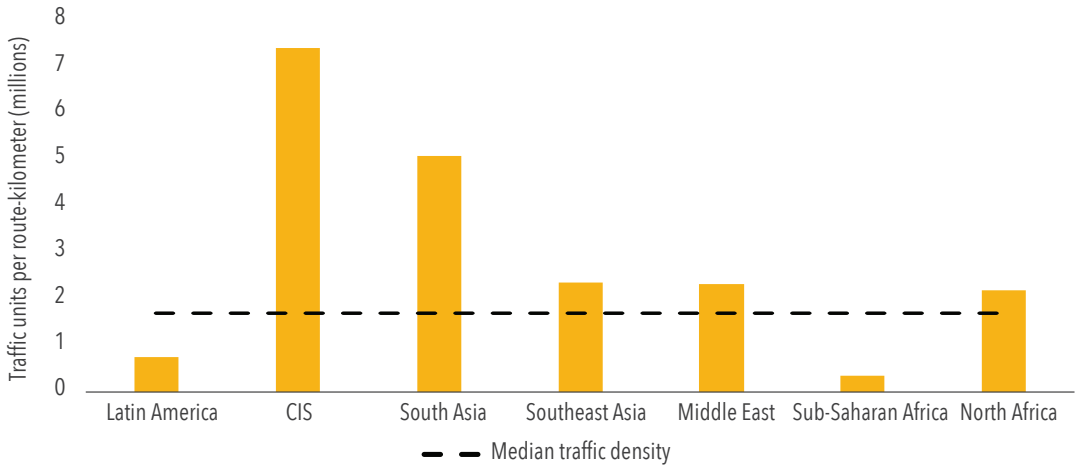
Line-haul tariffs are only part of the price equation for freight traffic. Much is often made of the inherent lower cost of rail as compared to road. This is certainly true where minerals have to be transported from a rail-connected mine to a rail-connected port. But the advantage is less clear-cut for medium-distance general freight, which is often transported by road to and from the railheads. Haulage between the railway and the ultimate origin and destination can often cost up to the equivalent of 200 kilometers to 300 kilometers of line-haul transport, negating any advantage rail may have in pure line-haul tariffs. New sidings are sometimes constructed, but such sidings need a minimum traffic volume to be economical for a railway. Traffic that needs to be transshipped at a central depot before being dispatched by rail is thus more vulnerable to road competition, and even bulk traffic is not immune to such competition if distances are not too great. In numerous countries, collection and distribution chains for many commodities are being streamlined, often involving the elimination of upcountry depots and distribution centers, and marketing channels have become more diversified. Railways have often been slow to respond, steadily losing market share, and this emphasizes the need for them to actively develop efficient multimodal services specifically designed for customer needs.

Network density

Network density is important because railways—especially railway infrastructure—have relatively high fixed costs and low variable costs. For railway infrastructure, the proportion of costs that are fixed will "differ by lines and traffic levels but rarely is estimated at less than 70 percent" (World Bank 2017) and is often closer to 100 percent for low-density lines. As a result, railway profitability is normally highly correlated with traffic density. Railways with high dedicated flows thus tend to be more profitable and financially sustainable.

As shown in figure 1.4, traffic volumes on general-purpose Sub-Saharan Africa (SSA) railways are low

Figure 1.4. Median Railway Traffic Density by Region



Source: See appendix A for country-level raw data and appendix B for country-level source information.
Note: CIS = Commonwealth of Independent States.

and network densities (expressed as traffic units[2] per route-kilometer) are correspondingly low. The highest median network traffic densities are in the CIS and South Asia. Both Southeast Asia and the Middle East have median densities above 2 million traffic units, but both Latin America and Africa are well below 1 million. This does not mean no traffic exists in either of the latter two regions. The Brazilian ore lines and the South African mineral lines are some of the busiest in the world; however, they also have extensive networks, much of which is carrying very little traffic. By comparison, in Europe most systems average 2 million to 5 million traffic units, with densities below 1 million found only in Albania and Montenegro. Many of the railways covered in this report lightly used by world standards.

Many networks struggle to generate enough funds from their own resources to maintain and renew their infrastructure as required. It is possible to operate railways without external financial support at these densities, but not forever, and generally only with a low level of service. For low-value traffic, this is not necessarily a problem, but for passenger services and for higher-value freight subject to road competition, it is a very difficult task. If a government wants a reasonable level of service at such densities, it needs to provide ongoing financial support.

Productivity

Both labor and asset productivity (locomotive and wagon utilization) are low in many railways, due to the poor condition of the infrastructure and rollingstock, low traffic levels, and government ownership. Almost all railway companies have streamlined their work forces over the past 20 to 25 years. In Africa and Latin America, this was often the prelude to concessioning, but in some cases has also been part of a general policy to improve efficiency. Despite this, labor productivity on many systems is relatively low by world standards, with the median for the railways in this review registering at just over 630,000 traffic units per staff per annum (figure 1.5). The low productivity often reflects use of labor-intensive methods with relatively little outsourcing. But for many systems with very low productivity, it is the consequence of traffic steadily declining without any adjustment to staff levels. With low wages in many of the countries, the direct financial impact is not always fatal. But a large body of staff who are semi-employed has a corrosive effect on morale and is a strong disincentive for those who wish to improve efficiency. It is also a powerful factor in limiting the general pay level of rail workers. Unless salary levels are competitive, railways find it hard to recruit and retain technically competent staff or to introduce the technology required to improve service levels, for which a better paid and more skilled workforce is essential.

The regional medians in figure 1.5 conceal large variations within the region. For example, the labor

Figure 1.5. Median Railway Labor Productivity by Regional

Source: See appendix A for country-level raw data and appendix B for country-level source information.
Note: CIS = Commonwealth of Independent States.

productivity in India is at least three times higher than in the other three South Asia systems. A clearer picture is given in the report's regional chapters, which present productivity for each country.

Profitability

Most state-owned railways just about break even on a cash basis, after receipt of government support. But often this is because a significant amount of maintenance has been deferred. When the maintenance backlog becomes too great, it is typically addressed using a grant from government or a loan, with the expenditure being treated as investment.

Passenger services generally do not contribute significantly to the cost of maintaining infrastructure or to covering corporate overheads. Many passenger services struggle to cover their marginal costs (train crew, rollingstock maintenance, fuel and/or traction electricity, and passenger handling costs). Passenger tariffs on many railways are government-prescribed, often within a framework that only includes a subset of total costs. Even if they had freedom to set their own tariffs, many of the more poorly performing systems would be unable to cover above-rail working expenses on a systemwide level.

Freight services normally cover their avoidable operating costs. Some earn enough to also cover rollingstock capital costs and even infrastructure costs. This is a function on the revenue side of the tariff rate and the average wagon loading and, on the cost side, of factors such as train size, commercial speed, and rollingstock utilization and availability. General freight can typically earn enough to make operating services worthwhile, but only in some cases can general freight fund the replacement of rollingstock, and very rarely can it earn enough to pay for infrastructure renewal.

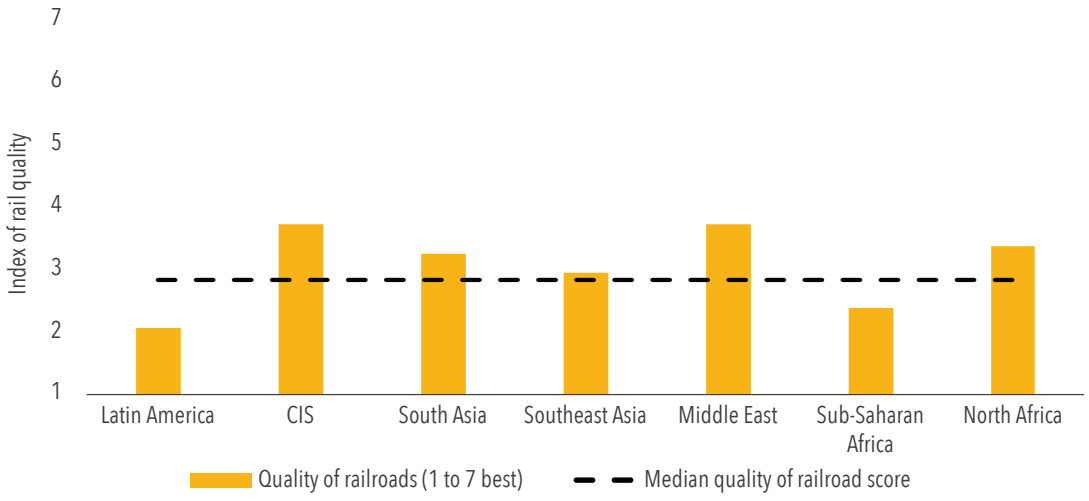
Quality of service

Finding an indicator of quality of service applicable across all railways is difficult. If the public is surveyed, their response will inevitably be in terms of passenger service, and this will also be the case with many businesses in the service sector. Manufacturers will consider the quality of the general freight service, either domestically or, more broadly, the handling of import and export shipments. Manufacturers will be primarily concerned with speed and reliability of service, damage, and cargo security. Shippers of bulk traffic will also weight cost as an important factor.

As illustrated in figure 1.6, the indicator adopted for this study is the World Economic Forum (WEF) survey on the quality of railroad infrastructure for 2017-18.[3] The quality of railway service covers a wide range of activities and, because the assessments are done by local businesses, consistency in the scores is not guaranteed, although the order of magnitude provides a general guide.

To provide some context for these indexes, the United States scores 5.5, Germany 5.5, Japan 6.6, and Australia 4.1.

Figure 1.6. Median Index of Rail Quality for 2017–2018 by Region



Source: WEF 2017.
Note: CIS = Commonwealth of Independent States.

Notes

1. This statistic measures the distance of the network. It does not take into account whether lines are single-track or double-track, nor does it include sidings and yards.
2. The traffic units carried by a railway are the sum of the passenger-kilometer and the net ton-kilometer. Although it has some limitations as an indicator (for example, a first-class passenger-kilometer in a high-speed train à grande vitesse (TGV) is treated identically to a passenger-kilometer in a crowded suburban train); it is a widely used, simple standard measure.
3. The quality of railroad infrastructure indicator is one of the components of the Global Competitiveness Index published annually by the World Economic Forum (WEF). It represents an assessment of the quality of the railroad system in a given country, based on data from the WEF Executive Opinion Survey, a long-running and extensive survey tapping the opinions of over 14,000 business leaders in 144 countries. The score for railroad infrastructure quality is based on only one question. The respondents are asked to rate the railroads in their country of operation on a scale from 1 (underdeveloped) to 7 (extensive and efficient by international standards). The individual responses are aggregated to produce a country score.

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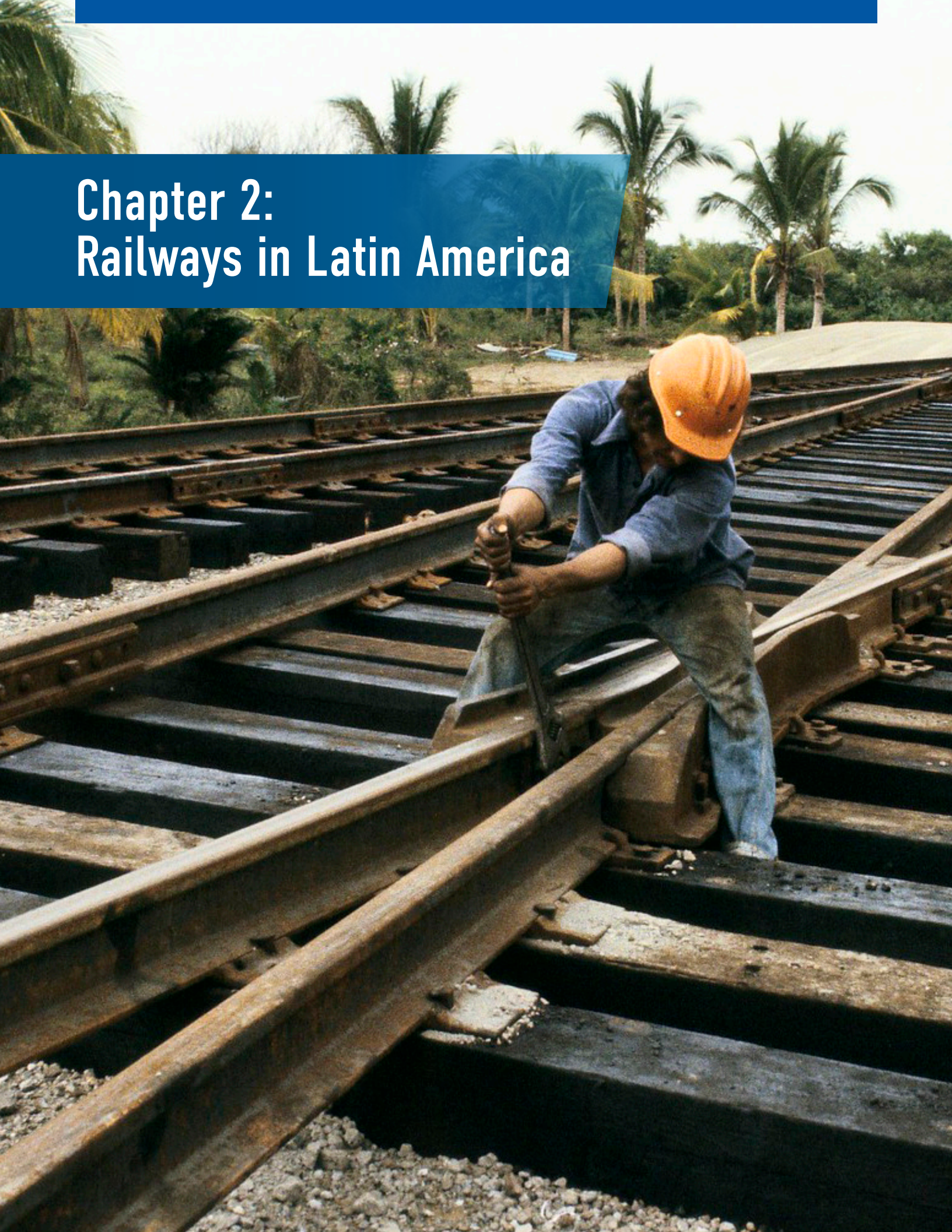
Chapter 2:
Railways in Latin America



Introduction

This chapter presents a brief overview of the status of railways in Latin America. Argentina, Mexico, and Brazil have substantial rail networks, while Chile has a smaller one. Most operate under concessions or management agreements. All railways went through a period of network downsizing, but now major new lines are being constructed in Brazil to develop the northern and western regions of the country. Small sections of the Bolivian, Colombian, Costa Rican, and Peruvian networks are also still operational. Several private, mining-related railways connect inland mines with ports on the Pacific coast (map 2.1). Mining and tourist railways and not covered in this summary.

Map 2.1. Railways in Latin American Countries

Source: Map produced by the World Bank Geospatial Operations Support Team (GOST).

Although freight services—some quite substantial—operate in most countries, nonurban passenger services are minimal; Brazil has almost none, Argentina has a limited network, and Chile has a few services south of Santiago. Some other services are predominantly for tourists or are remnants operating in areas with no or very few roads. Almost all interurban public transport in these countries is now done by air or bus. However, major urban railways operate in Buenos Aires and in the major Brazilian cities as well as in Santiago. In most cases these complement metro systems.

This chapter summarizes the key characteristics of the railways, as included in the Developing Country Railway Database (appendix A). The data have been collected from various public sources—annual railway or regulator reports and/or national statistical annuals; most data are for 2018. All median figures shown in the graphs reflect the representative sample of railways included in this report and, importantly, the sample does not include some large railway networks, including those in North America, Europe, and China.

Institutional Structure

Few of the railways in Latin America were financed by government, with most constructed as concessions, predominantly financed by investors from the United Kingdom and the United States, and subsequently nationalized. By the 1950s, most countries had constructed large government-owned systems. However, the growth in good roads and competition from road transport, from the 1960s onwards, combined with limited financial support from the government for rail, created a vicious circle of revenue decline, sharp falls in service quality, and a failure to maintain and renew both infrastructure and rollingstock. In two cases (Ecuador and Paraguay) this cycle proved fatal, with only a few tourist trains and local cross-border services surviving.[1]

In most other countries, the decline drove governments to restructure the railways into a series of vertically integrated, regionally based concessions (figure 2.1).[2] The concessions have proven more successful in some countries than in others. Brazil has, broadly speaking, been a success, as has Mexico. Argentina has had mixed results, with the government gradually taking back control of both the freight and urban

Figure 2.1 Private Sector Participation (PSP) in Latin American Railways Since 1990

Source: Original map produced for this publication.
Note: In Colombia, only one of the two is currently operational.

passenger concessions. Currently, Latin America has 41 freight railroad operators that provide public service (figure 2.2 details the management models used by the different countries). Thirty-one of these operators are managed by the private sector (mostly concessionaires) and 10 are state-owned companies. Bolivia, Peru, and Colombia have two concessions each (only one of which in Colombia is operational, solely for export coal), all disconnected and serving separate regions in each country. In Panama, the railway has always been a concession, dating back to before the Panama Canal opened.

The railways in Uruguay and Venezuela have remained as integrated government-owned railways even though they carry comparatively little traffic. The railway in Costa Rica is currently being revived and operates a commuter service as well as a small freight service.

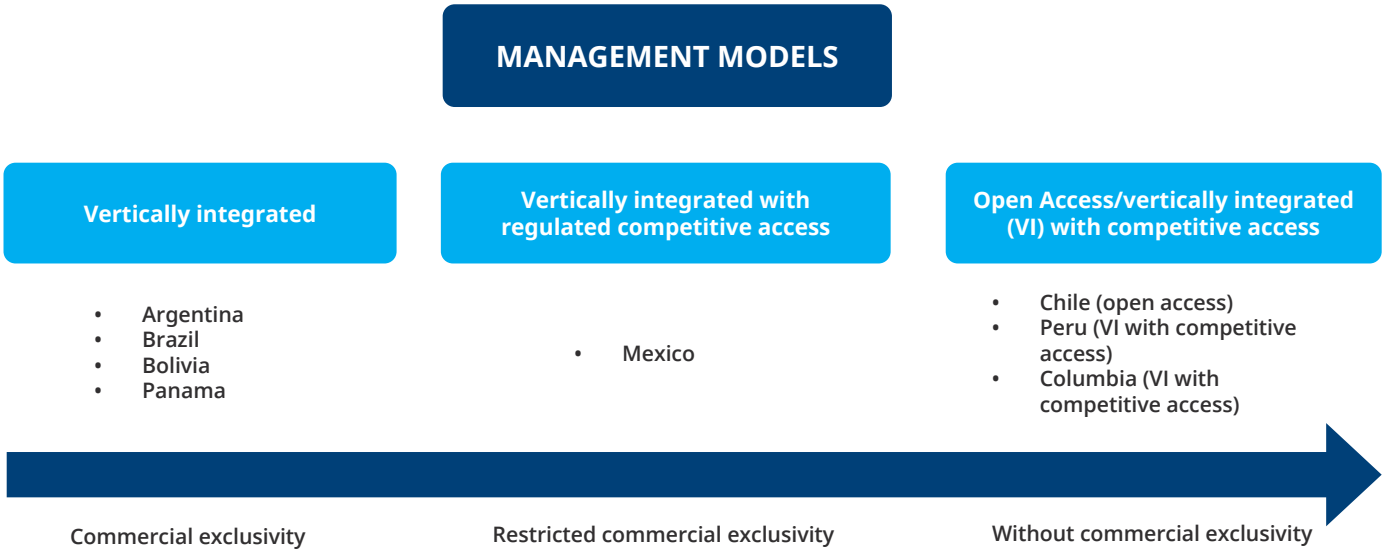
Chile has a mixture: privately operated mineral lines in northern Chile and a government-dominated system in southern Chile. The privately operated lines remain vertically integrated, but the government system has a government-owned infrastructure and operations company, with third-party operators allowed to access the network.

Brazil, Argentina, Peru, and Mexico all have specialist transport regulatory bodies that monitor the operational and financial performance of the various concessions in addition to other modes. Chile does not. In Bolivia, the concession is monitored by a joint transport and telecommunications agency, while other countries manage the concessions through the relevant government ministry. However, Colombia has created an independent agency that has yet to start functioning. The regulatory bodies do not all have the same powers, but typically are responsible for technical and economic regulation, accident investigation, and arbitration of disputes.

Construction and reconstruction of infrastructure is generally funded by the government. The only exception is where lines are constructed for substantial volumes of mineral transport, as with the Carajas iron-ore line in Brazil and the coal line in Colombia.

For the past 25 to 30 years most Latin American railways have been concessioned. During that time, some have thrived, others have survived, and still others have collapsed and returned to government control. Sharp (2005) and Kohon and Abad (2021) provide detailed reviews of the situation as of 2005 (10 to 15 years after concessioning) and as of now, including analyses of changes in traffic volumes and productivity.

Figure 2.2. Management Models in Privately Managed/Concessioned Railroads in Latin America



Source: Kohon and Abad 2021.

Suburban passenger rail services are operated in 18 cities in Latin America (seven in Brazil, four in Argentina, three in Chile, and one each in Costa Rica, Mexico, Uruguay, and Venezuela). Four of the 14 commuter operators are private-sector concessionaires (two in Argentina, one in Brazil, and one in Mexico).

Seven countries (Argentina, Bolivia, Brazil, Chile, Mexico, Peru, and Uruguay) have at least one long-distance passenger service. In four of these countries (Bolivia, Brazil, Mexico, and Peru), services are provided by freight concessionaires.

The history of concessioning in the region means Latin American countries have received the highest private investment in railway infrastructure among all regions in the past three decades, amounting to a total of approximately US$68 billion. The highest investments have occurred in Brazil, followed by Argentina.[3]

In 1998, the Organisation for Economic Co-operation and Development (OECD) developed a set of indicators of product market regulation (PMR) to measure a country's regulatory barriers to competition and to track reform progress over time. The PMR indicators measure the degree to which policies promote or inhibit competition in markets for products and services, collecting information on how entry and behavior in the relevant sector are regulated, and on the level of public ownership. They reflect the status of the existing laws and regulations, though do not capture the level of enforcement. The values range between 0 and 6, from least to most competition friendly regulatory regime. Table 2.1 reflects the scores for the railway sector in Latin American countries, using the PMR methodology and inputs from a regional railway expert.[4]

Table 2.1. Product Market Regulation Scores for Latin American Countries, for 2020

Country	PMR score	Economic regulator		Safety regulator	
Bolivia	3.43	Yes	Independent Authority	Yes	Independent Authority
Chile	3.00	No	n.a.	No	n.a.
Mexico	2.36	Yes	Ministry	Yes	Ministry
Peru	1.71	Yes	Independent authority	Yes	Ministry
Uruguay	3.00	No	n.a.	No	n.a.
Argentinaa	3.49	Yes	Ministry	Yes	Ministry
Brazila	3.22	Yes	Ministry	Yes	Ministry

Source: Original calculations based on the OECD product market regulation (PMR) methodology. For more information, see: https://www.oecd.org/economy/reform/indicators-of-product-market-regulation/.
Note: n.a. = not applicable. a. Argentina and Brazil are available in the original OECD 2018 PMR Database but have been recalculated based on the detailed responses available on the OECD website, to ensure uniformity in the scoring method (following the OECD schemata).

Current Situation

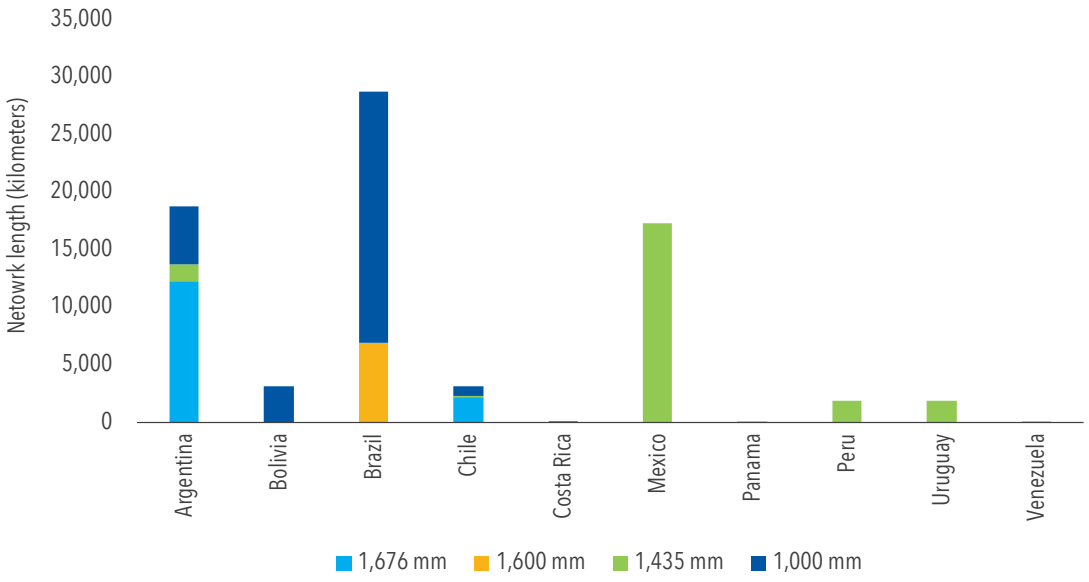
Networks

Railway development followed a similar pattern in almost all Latin American countries. Lines headed inland from a port to reach a trading center or a mine. Branch lines were then built to serve developing areas, particularly in the rich agricultural or mining areas of Argentina, Uruguay, and Brazil. However, the improvement of the road system, combined with changes in collection and distribution networks, saw the loss of much of the shorter-distance traffic on such lines.[5] Although there have been grand master plans for more than a century, much of the South American network remains as disconnected lines, both between countries as well as within countries. Within the region, international links connect Argentina, Uruguay, Brazil, Bolivia, and Paraguay (and theoretically also Brazil), but the only one line, between Brazil and Bolivia, handles any significant traffic.[6]

At the end of 2019, the operating public networks in Latin America totaled about 76,000 kilometers, even though all Latin American rail networks have downsized considerably. Networks in individual countries range from 41 kilometers in the smallest operating public railway (Venezuela) to 23,000 route-kilometers in Brazil (figure 2.3).[7] In addition to these networks, privately operated mineral lines continue to provide service, especially in Colombia, Chile, and Peru. Two lines in Brazil carry large volumes of iron ore as well as general freight and the only two intercity passenger services in the country (2,000 kilometers, included in figure 2.3).

Gauges are mixed, with 1,676 millimeters in Argentina and parts of Chile; 1,600 millimeters in Brazil; standard gauge (1,435 millimeters) in Uruguay, Venezuela, Mexico, Panama, parts of Argentina and Brazil, and some Andean lines; meter gauge in Argentina, Brazil, and the Andes; and Cape gauge (1,067 millimeters) in Costa Rica.

Figure 2.3. Railway Route-Kilometers in Latin American Countries, 2018



Source: See appendix B for country-level source information.
Note: mm = millimeters; Route-kilometers in Costa Rica, Panama, and Venezuela are too small to register on the graph. The graph includes nonoperational lines.

Many Latin American networks still operate at the standards to which they were originally constructed. Almost all lines are single track; the exception is the suburban networks, which are also the only electrified lines (see box 2.1.) Main-line infrastructure, where services operate under commercial concessions, is generally in reasonable (and in many cases good) condition. Lines with lower traffic volumes have considerable sections requiring repair or replacement, with speed restrictions over long sections, resulting in a loss of railway competitiveness and rollingstock productivity. Signaling ranges from very modern systems on the high-density commercially profitable lines to much simpler and older systems on lower-density lines.

Traffic

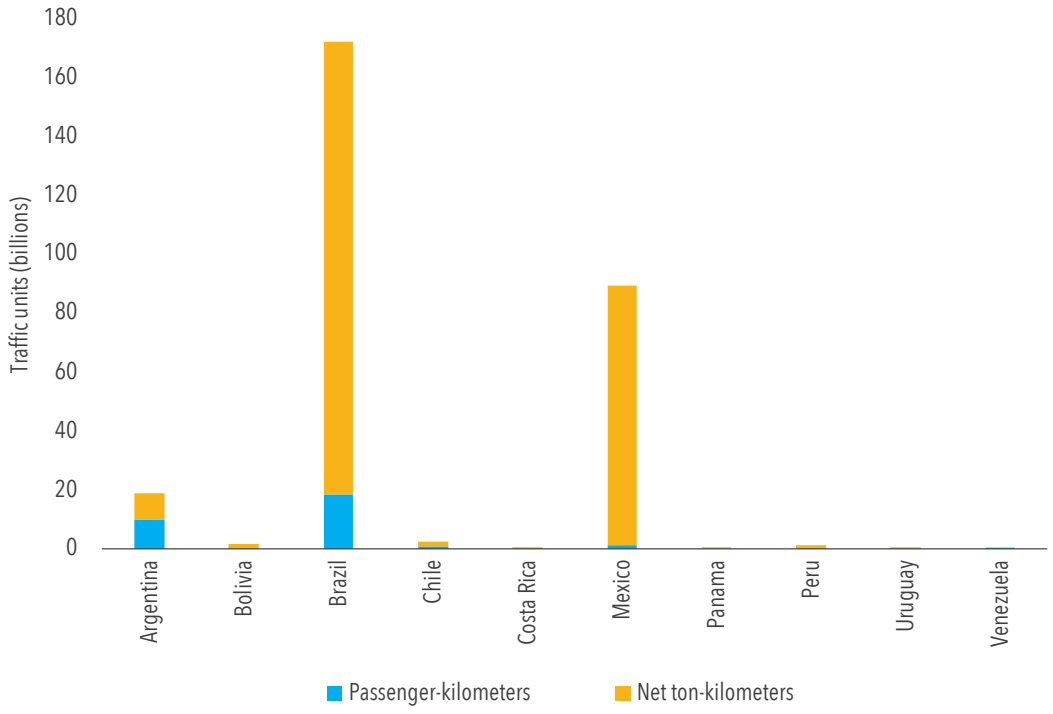
Brazil is by far the most important freight railway (figure 2.4), even without the export of iron ore (omitted from the figure but would represent an additional 250 billion net ton-kilometers of freight). Much of the non-iron-ore traffic is bulk and semibulk freight such as agricultural products, steel, and cement. Brazil and Argentina also dominate the passenger business, because of their heavy suburban passenger traffic. Some other Latin American cities also operate (or have operated) suburban services, though these are generally only on one or two lines radiating from the capital cities (see box 2.1.)

In total, excluding the iron-ore traffic in Brazil, the railways annually carry over 250 billion net ton-kilometers of freight and about 35 billion passenger-kilometers.

Pricing

Almost all remaining nonurban passenger services face strong competition from buses and shared taxis in terms both of price and of service frequency, and very few corridors remain in which rail passenger services are the only effective means of transport. Many of the average passenger fares are an upper estimate, as they have generally been estimated from typical published fares, which creates difficulties

Figure 2.4. Railway Traffic in Latin American Countries, 2018



Source: See appendix B for country-level source information.
Note: Excludes 250 billion net ton-kilometers (ntkm) of Brazilian iron-ore traffic.

Box 2.1. Suburban Railways in Latin America

Argentina has a substantial suburban passenger network in Buenos Aires, with 950 route-kilometers, of which 257 kilometers are electrified. It operates a mixture of loco-hauled and multiple-unit services and carried 424 million paying passengers in 2018. The Buenos Aires subway carried an additional 330 million passengers. All the lines were at one time concessioned, but they have now all been brought back under government management.

Brazil has about 700 route-kilometers of suburban networks in six cities, mostly operated by (Brazilian) state-owned railways. In total, they carry about 900 million passengers per annum. The largest by far is in São Paulo, with 678 million passengers in 2018, followed by Rio de Janeiro's Supervia concession, with 163 million, and Recife, with 102 million.

In Chile, the state-owned infrastructure and passenger concessionaire operates suburban services on two independent routes in Santiago and Valparaiso, with about 40 million passengers between them.

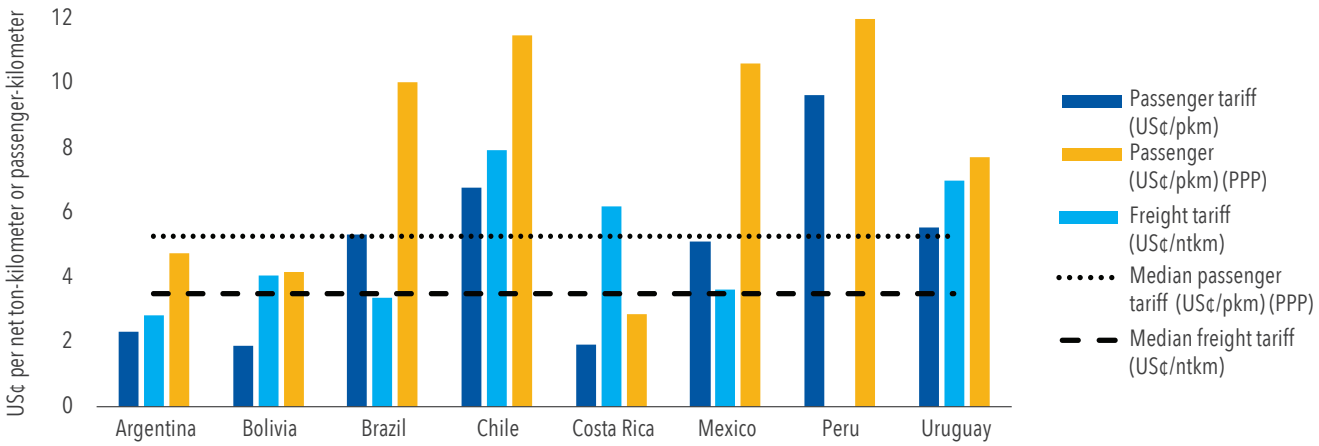
Venezuela also operates a commuter service on one route in Caracas, reportedly carrying about 12 million passengers annually, and in Costa Rica three routes centered in San José currently carry about 3 million passengers per annum.

Source: World Bank analysis.

in allowing for season tickets or multimodal zonal tickets. The Peruvian average tariff is heavily influenced by the (essentially tourist) trains to Machu Picchu. Figure 2.5 illustrates the average passenger and freight tariffs for Peru and other Latin American countries for 2018.

Average freight tariffs on the major networks range from US$0.025 to US$0.08 per net ton-kilometer, similar to tariffs on other general-freight railways in comparable countries. Tariffs are higher in Chile (because of the topography), and for the small volume of freight traffic in Uruguay. Tariffs are generally constrained by competition, principally

Figure 2.5. Average Railway Tariffs in Latin American Countries, 2018



Source: See appendix B for country-level source information.
Note: ntkm = net ton-kilometer; pkm = passenger-km; PPP = purchasing power parity; US¢ = US cent (1/100 of US$1). Passenger tariffs represent best estimates based on revenues and estimated passenger-kilometer.

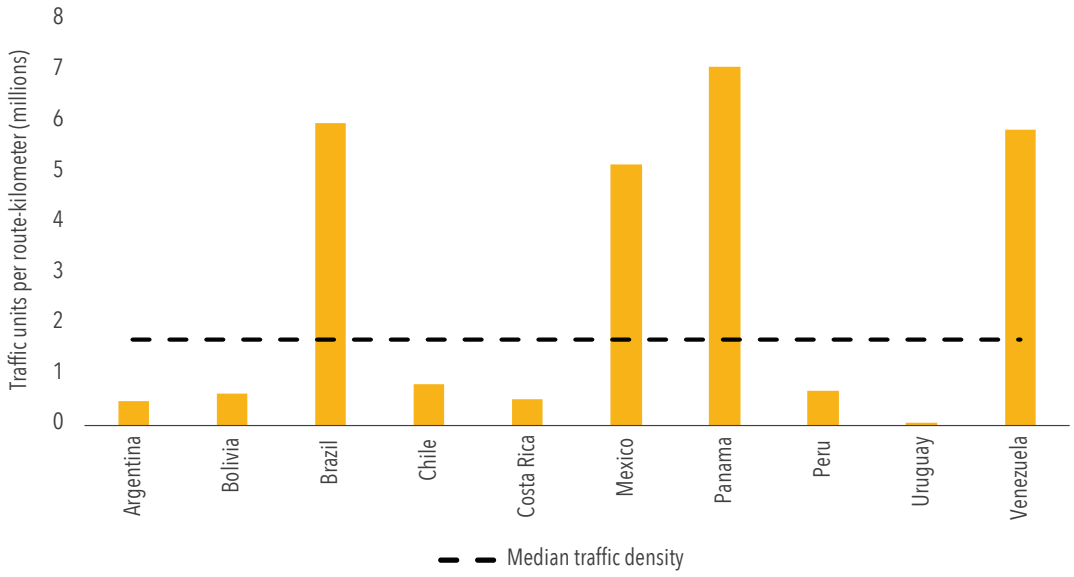
from roads, or in some cases from alternative rail routes, and are also influenced by the traditional value-based tariff structures, the relative cost of carrying different commodities (as reflected in net tons per wagon roundtrip), direction of travel, and volume. Although relatively few freight tariffs are regulated, passenger tariffs in some countries (for instance, Argentina) are set by regulators.

Line-haul tariffs comprise only part of the equation for freight traffic. Much is often made of the inherent lower cost of rail compared to road. This is certainly true where minerals have to be transported from a rail-connected mine to a rail-connected port but is not so clear-cut for medium-distance general freight, which is often also transported by road to and from the railheads. Haulage between the railway and the ultimate origin and destination can be expensive, often as much as 200 to 300 kilometers of line-haul transport, negating any advantage rail might have in pure line-haul tariffs. New sidings are sometimes constructed, but these require a minimum traffic volume to be economical for a railway. Traffic that needs to be transshipped at a central depot before dispatching by rail is thus more vulnerable to road competition, and even bulk traffic is not immune if distances are not too great. In many countries, collection and distribution chains are being streamlined, often involving the elimination of upcountry depots and distribution centers, and marketing channels have become more diversified. The railways have been slow to respond, resulting in a steadily declining market share.

Traffic density

Traffic density is important because railway infrastructure has relatively high fixed costs and low variable costs. As a result, railway profitability is highly correlated with traffic density. Figure 2.6 gives the traffic densities on the nonurban sections of the networks, that is, excluding the suburban traffic, which is particularly high in Argentina and Brazil. This graph excludes the iron-ore traffic in Brazil, to be more representative of the average density on the network as a whole. It also excludes the coal export line in Colombia operating under concession.

Figure 2.6. Rail Traffic Density in Latin American Countries, 2018



Source: See appendix B for country-level source information.
Note: The graph excludes Colombia for which only a 150 kilometer private standard gauge line (out of the 3,300-kilometer railway network) is operating and transporting coal from Cerrejón mines to the port of Puerto Bolivar at Bahia Portete, with a freight traffic density of around 52 million ton-kilometers per kilometer.

Network densities on five of the Latin American networks (Brazil, Mexico, Colombia, Panama, and Venezuela) each total more than 5 million traffic units. The first four of these railways are concessioned, with all infrastructure and rollingstock investment financed by the concessionaires. (Venezuela's is a short government-owned suburban line.) The Peru network, also concessioned, has a density of about 2 million traffic units for operational sections, and most investment is financed by the concessionaires. The remaining networks have low traffic densities of about 500,000 or fewer traffic units. As is the case elsewhere in the world, most of these networks struggle financially. In some cases, they rely on the government for funding of infrastructure maintenance and in nearly all cases for funding of infrastructure investment.

Productivity

Labor and rollingstock productivity (locomotive and wagon utilization) offer a similar picture to network density. Figure 2.7 presents estimated labor productivity for 2018 in those networks for which reliable employment data are available.

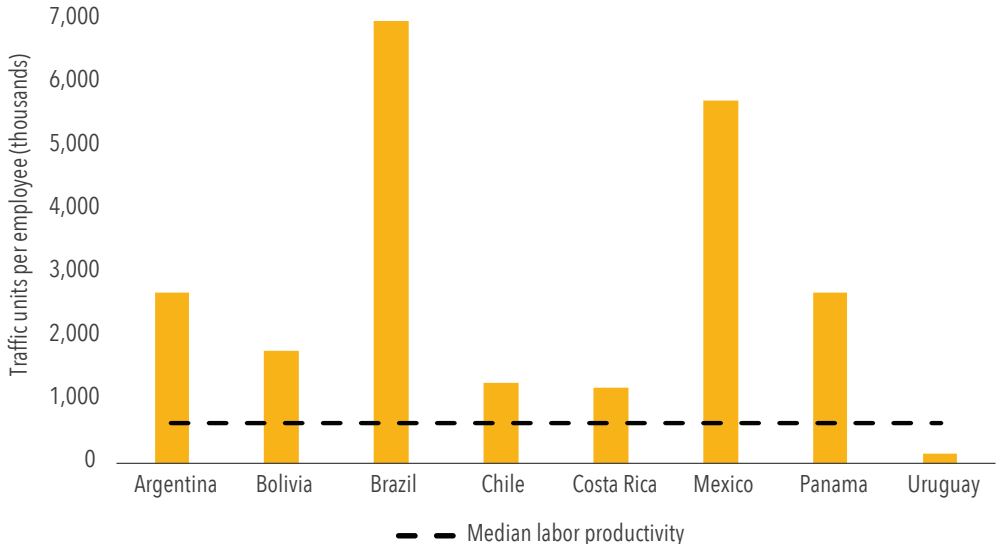
The three networks with high traffic density (Argentina, Brazil, and Mexico) all have high labor productivity. Panama's labor productivity is lower than that of Brazil and Mexico, because of the short average haul across the isthmus, with a much higher proportion of time and effort spent in terminal loading and unloading. The other three networks have much lower levels of productivity, some of which are likely due to the much lower level of investment in labor-saving assets over the past 40 years.

Nevertheless, with the exception of Uruguay (which is almost moribund), labor productivity is certainly as respectable as many railways elsewhere in the world.

Quality of service

It is difficult to find an indicator of quality of service applicable across all railways. If the public is surveyed, their response will inevitably be in terms of passenger service, and this will also be the case for many businesses in the service sector. Manufacturers will consider the quality of the general freight service, either domestically or, more broadly, the handling of import/export shipments. Manufacturers will be primarily concerned with speed and reliability of service, damage, and cargo security. Shippers of bulk traffic will also weight cost as an important factor.

Figure 2.7. Railway Labor Productivity in Latin American Countries, 2018

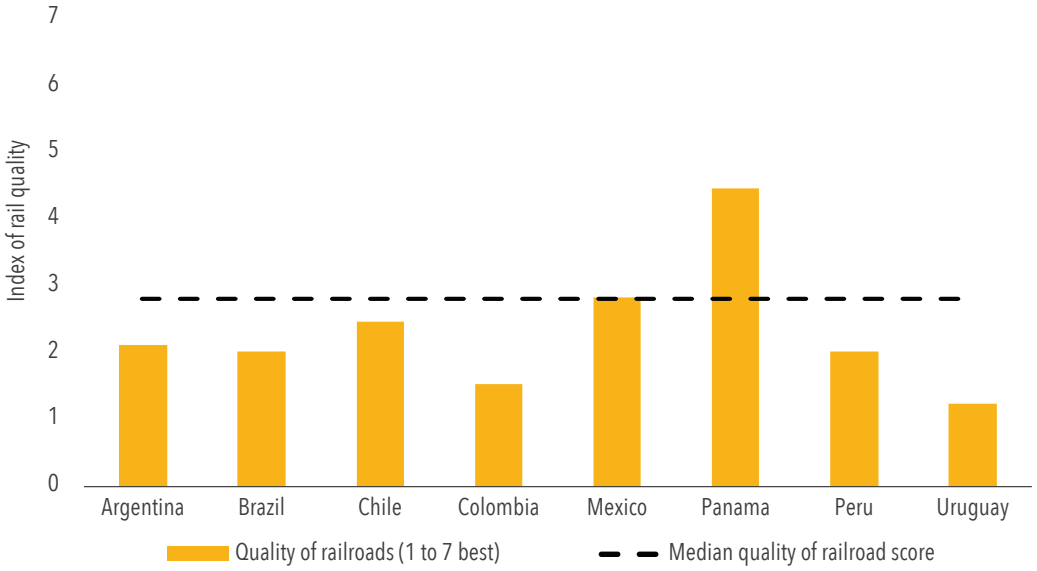


Source: See appendix B for country-level source information.
Note: Data not available for Colombia, Peru, and Venezuela.

The indicator adopted for this study is the World Economic Forum (WEF) survey for 2017 and 2018 on the quality of railroad infrastructure (see figure 2.8).[8] The quality of railway service covers a wide range of activities and, because the assessments are done by local businesses, they offer no guarantee of consistency in the scores, although the order of magnitude provides a general guide.

To provide some context for these indexes, the United States scores 5.5, Germany 5.5, Japan 6.6, and Australia 4.1.

Figure 2.8. Index of Railroad Infrastructure Quality in Latin American Countries, 2017–2018



Source: WEF 2017.
Note: Data not available for Bolivia, Costa Rica, or Venezuela.

Notes

1. And, in the case of Colombia, a concessioned line is solely for export of coal. Paraguay has a small, isolated cross-border service with Argentina.
2. A vertically integrated railway has both infrastructure and operations managed by the same organization. A vertically separated railway has the organization managing the infrastructure being separate from that (or those) operating train services. In the separated case, the train operators pay access charges for the use of the infrastructure, similar in concept to the charges made on a toll road. Many variations on these two basic models exist. For example, in Brazil about 10 percent of the total operations are by one operator on the infrastructure of another. This can be by mutual agreement or as of right, depending on the legislation.
3. Data from the World Bank Private Participation in Infrastructure (PPI) Database (https://ppi.worldbank.org/en/ppi).
4. Argentina's and Brazil's responses are taken from the 2018 OECD Database.
6. The average distance freight is carried in Argentina is now 485 kilometers. In Brazil the distance (excluding iron ore) totals 822 kilometers, with the trains traveling about 1,000 kilometers. The longest distance on the Uruguay network is about 500 kilometers.
7. The link between Mexico and the United States carries a lot more traffic than any of the intraregional railway links.
8. The Quality of Railroad Infrastructure indicator is one of the components of the Global Competitiveness Index published annually by the World Economic Forum (WEF). It represents an assessment of the quality of the railroad system in a given country, based on data from the WEF Executive Opinion Survey, a long-running and extensive survey tapping the opinions of more than 14,000 business leaders in 144 countries. The score for railroad infrastructure quality is based on only one question. The respondents are asked to rate the railroads in their country of operation on a scale from 1 (underdeveloped) to 7 (extensive and efficient by international standards). The individual responses are aggregated to produce a country score.

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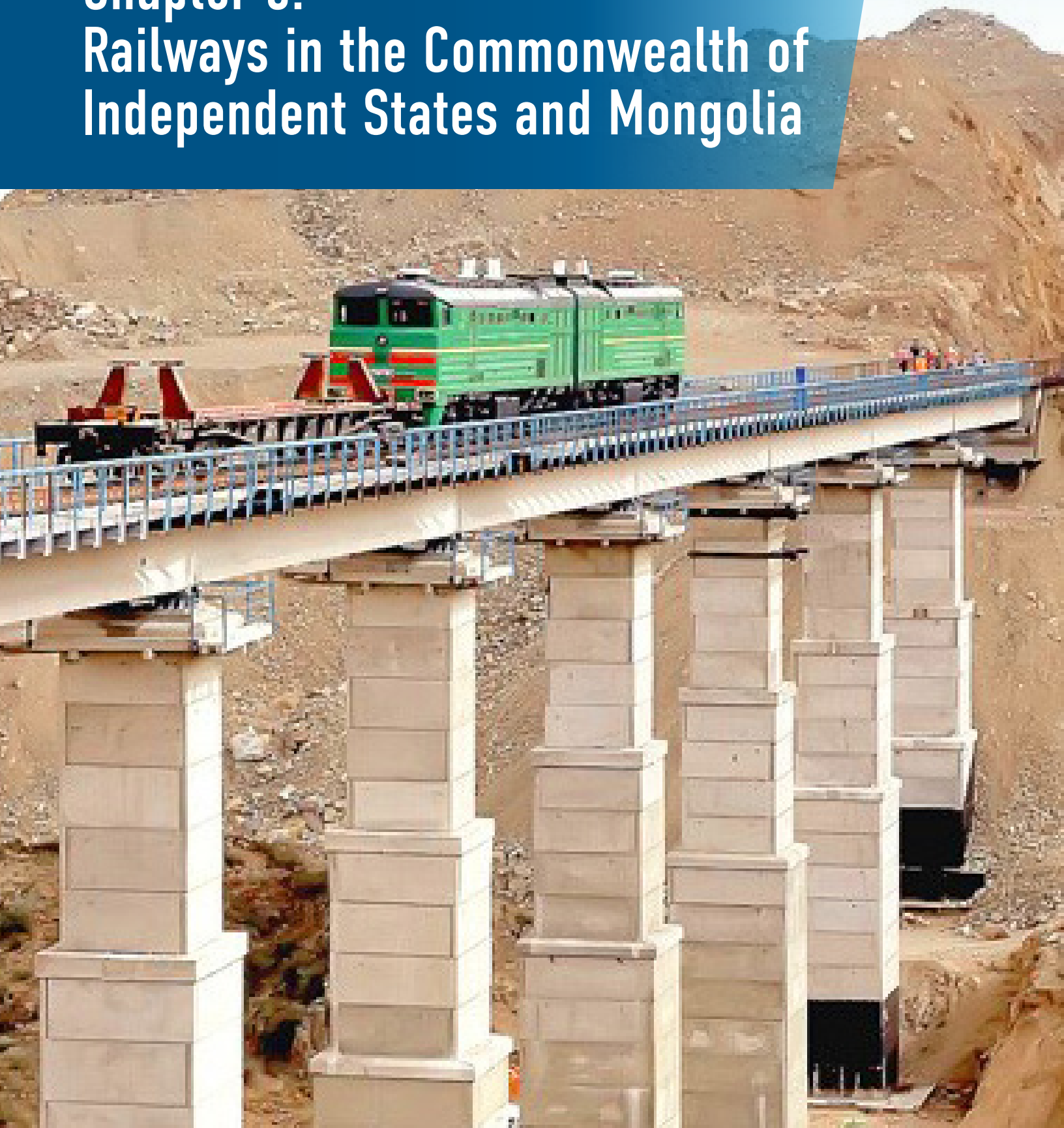
Chapter 3:
Railways in the Commonwealth of Independent States and Mongolia



Introduction

This chapter presents a brief overview of the railways in the Commonwealth of Independent States (CIS) and Mongolia. The CIS covers Belarus, Ukraine, Moldova, Russia, Kazakhstan, the Kyrgyz Republic, Uzbekistan, Turkmenistan, and Tajikistan.[1] All except Mongolia were formerly parts of the Union of Soviet Socialist Republics network, operating with common technical standards and operating procedures. The Mongolian network also operated to these same standards and procedures. Following the dissolution of the Soviet Union, the railways were transferred to the individual countries, but have largely continued to operate as before. Russia, Ukraine, and Kazakhstan have very large networks carrying heavy traffic. The other railways are smaller, and two (in the Kyrgyz Republic and Tajikistan) are very small, acting essentially as branches off the rest of the network (map 3.1). All remain state owned, with restructuring ranging from substantial in Russia and Kazakhstan to very little for the smaller railways.

The public Mongolian network,[2] stretching from the Russian border to the Chinese border, with a few short branches, is jointly owned by the governments of Russia and Mongolia, which alternate in appointing the general manager. This arrangement did not always suit the Mongolian government, which has also created a 100 percent Mongolian state-owned railway to develop new lines in the rest of Mongolia.

All CIS and Mongolian railways have passenger

Map 3.1. Commonwealth of Independent States and Mongolia Railways

Source: Map produced by the World Bank Geospatial Operations Support Team (GOST).

services; most are substantial. In the CIS, passenger services are divided into long-distance and prigorodne, which is often translated as "suburban."[3] Relatively few of these services are urban commuter services. Rather, they operate as regional passenger services (see box 3.1, later in the chapter).

Chapter 3 summarizes the key characteristics of the railways, as included in the Developing Country Railway Database (appendix A). The data have been collected from various public sources—principally statistics published by the Organisation for Co-operation between Railways (OSJD),[4] but also including annual reports where available. Most data are for 2018. All median figures shown in the graphs reflect the representative sample of railways included in this report and, importantly, that sample does not include some large railway networks, including those in North America, Europe, and China.

Institutional Structure

All CIS and Mongolian railways remain government owned. The railways in Russia, Ukraine, Kazakhstan, and Uzbekistan are companies with independent boards, while the others remain effectively government departments. The Ulan Bator Railway in Mongolia is a special case because it is jointly owned by Russia and Mongolia.

Since 2003, Russian Railways has allowed private operators of wagons to access the railway infrastructure using locomotives and crews provided by Russian Railways. While the law allows private operators to use their own locomotives and crews, this has not much materialized in practice. Kazakhstan also allows third-party access, including allowing operators to use their own crews and locomotives. The principle has been agreed, but not yet implemented in Ukraine. The greatest interest in third-party access has been shown by producers and users of bulk materials, such as iron ore and coal. Kazakhstan and Moldova are currently working toward separating their railways companies into separate infrastructure and train operating companies similar to the structure in the European Union. A similar effort is also in its early stages in Ukraine.

The larger railways are financially self-sustaining, in the sense that they can typically finance their own asset renewals and replacements. However, the smaller ones are chronically short of funds for major maintenance, and the condition of their infrastructure has been steadily deteriorating. Passenger fares, particularly for prigorodne services, are kept low in most countries by government policy and contribute little, if anything, to the cost of maintaining the infrastructure. However, this constraint often applies only to the lowest class of travel, and several systems have introduced higher-standard services that allow higher fares to be charged. Nevertheless, even these are insufficient to cover the infrastructure costs, and freight revenues are then required to cover the deficit.

The opening of infrastructure to private operators has brought considerable private investment in rail rollingstock. Private investment in railway infrastructure is more limited. Only three countries have seen private infrastructure investments in the past 30 years: Kazakhstan, Uzbekistan (part-divestiture), and Belarus (part-divestiture) with one project each, amounting to a total of US$330 million.[5]

In 1998, the Organisation for Economic Co-operation and Development (OECD) developed a set of indicators of product market regulation (PMR) to measure a country's regulatory barriers to competition and to track reform progress over time.

The PMR indicators measure the degree to which policies promote or inhibit competition in markets for products and services, collecting information on how entry and conduct in the relevant sector is regulated, and on the level of public ownership. The indicators reflect the status of the existing laws and regulations but do not capture the level of enforcement. The values range from 0 to 6, from the most to the least competition friendly regulatory regime. Table 3.1 reflects the scores for the railway sector in CIS, using the PRM methodology and inputs from a regional railway expert.[6]

Table 3.1. Product Market Regulation Scores for CIS Countries, 2020

Country	PMR score	Economic regulator		Safety regulator	
Belarus	5.14	Yes	Ministry	Yes	Ministry
Kazakhstan*	3.00	Yes	Ministry	Yes	Ministry
Kyrgyz Republic	5.57	Yes	Ministry	Yes	Ministry
Moldova	5.57	Yes	Ministry	Yes	Ministry
Russia	3.43	Yes	Independent authority	Yes	Ministry
Tajikistan	5.57	Yes	Ministry	Yes	Ministry
Turkmenistan	5.57	No	n.a.	No	n.a.
Ukraine	4.29	Yes	Ministry	Yes	Ministry
Uzbekistan	5.57	Yes	Ministry	Yes	Ministry

Source: Original calculations based on the OECD product market regulation (PMR) methodology. For more information, see: https://www.oecd.org/economy/reform/indicators-of-product-market-regulation/.
Note: n.a. = not applicable.

Current Situation

Networks

Prior to the breakup of the Soviet Union, the network of the CIS railways operated as a single system with 30 regional networks. These regional railways were subsequently grouped and divided to form the various national railways.[7] Many of the Central Asian lines zigzagged across national borders. Since the 1990s, many new lines have been constructed to ensure each country's network is internally connected as much as possible. However, both the Kyrgyz Republic and the Tajikistan networks have several isolated sections. Many international connections exist within the region between the CIS and Europe dating back a hundred years or more. Until 1991 there were only two connections between the CIS network and China—one from Russia, part of the original Trans-Siberian Railway, and one via Mongolia, constructed after World War II. A direct connection with Kazakhstan was then opened at Alashanko, with a second crossing opening at Horgos in 2018. These interchange points now handle the

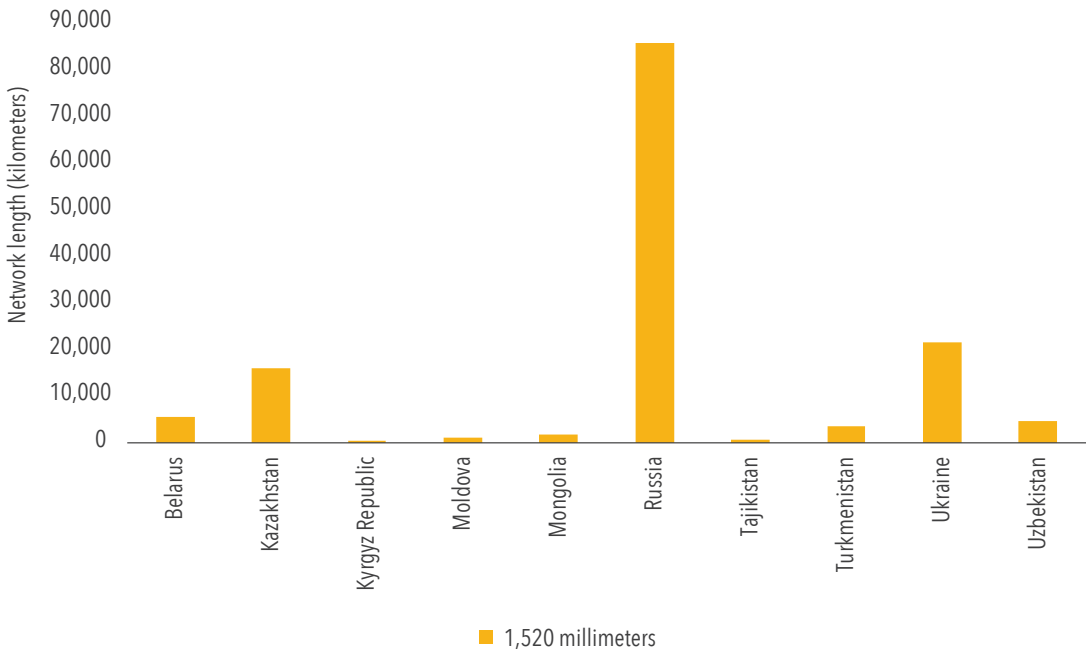
majority (normally around 70 percent) of the China–Europe rail traffic. Links also operate between Iran and Turkmenistan, and recently a link was built between Kazakhstan and Turkmenistan along the shores of the Caspian.

At the end of 2018, the operating public networks in the CIS and Mongolia totaled about 141,000 kilometers, of which the Russian network accounts for over 60 percent. It is all Russian gauge (1,520 millimeters to 1,524 millimeters). After Russia, the Ukraine network is the largest (21,000 kilometers), with 16,000 kilometers in Kazakhstan and 5,000 kilometers in both Belarus and Uzbekistan. The other networks are all under 2,000 kilometers (see figure 3.1).

Many parts of the Ukraine, Kazakhstan, Uzbekistan, and Belarus networks have been upgraded significantly over the years, including double tracking, electrification, and modern signaling. Russia operates higher speed—up to 250 kilometers per hour (kph)—passenger trains between Moscow, St. Petersburg, Helsinki, and Nizhny Novgorod. Uzbekistan operates trains between Tashkent and Samarkand/Bokhara at 200 kph and Kazakhstan operates a service between Almaty and Nursultan. However, these trains operate on upgraded conventional lines rather than new, dedicated passenger high speed lines.

The main-line infrastructure in the CIS network is generally in good condition, suited to the substantial traffic volumes carried. However, lack of funds has caused the smaller railways and some of the secondary lines to be maintained to lower standards, with resultant speed restrictions. Signaling ranges from very modern systems on the high-density lines to much simpler and older systems on lower-density lines.

Figure 3.1. Railway Route-Kilometers in the CIS and Mongolia, 2018



Source: See appendix B for country-level source information.

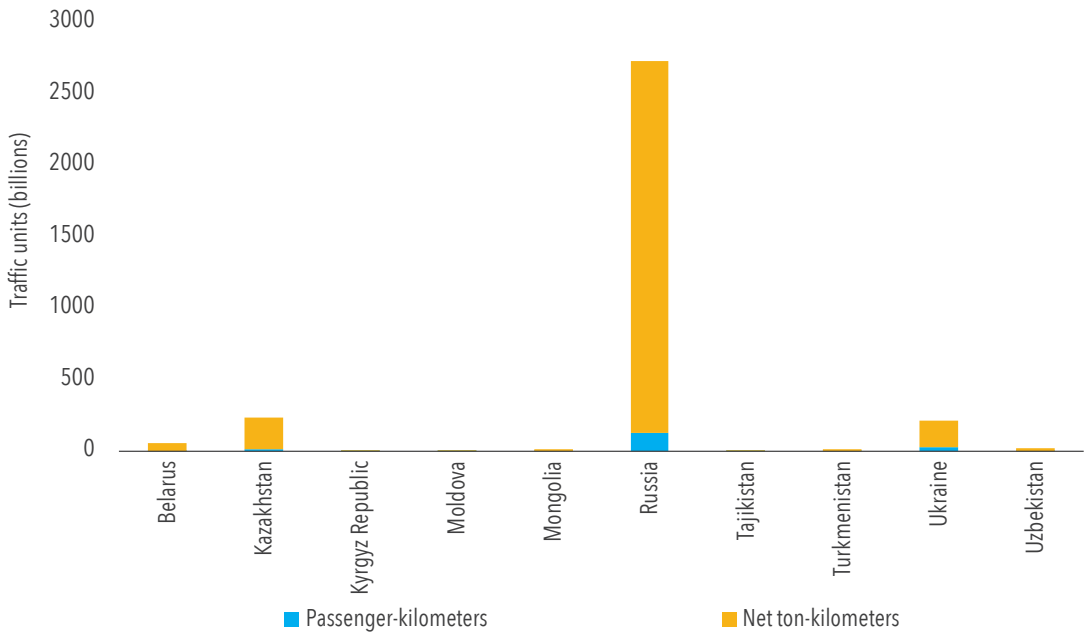
Traffic

In total, the railways annually produce more than 3 trillion net tons-kilometers of freight and over 190 billion passenger-kilometers. Russia carried over 80 percent of this freight and two-thirds of the passengers, followed by Kazakhstan and Ukraine (figure 3.2). The railways carry substantial amount of mining products, building materials, oil and oil products, metals, and grains.

Because these railways were all part of an integrated economy in Soviet times, and many are landlocked with limited access to seaports, a considerable amount of interchange traffic exists. Outside of Russia, about 50 percent of the traffic in the region is domestic (that is, wholly within a country's borders), about 30 percent is export (going to either to neighboring countries or to seaports), 10 percent is imports, and 10 percent is transit traffic (this last amount includes these railways' share of the new China–Europe traffic). Though generally modest, road competition for the bulk traffic exists. Road competition for general freight is strong—especially for consumer goods—even over surprisingly long distances.

Relatively high-standard long-distance passenger services is offered between the major population centers, as well as the prigorodne services described in box 3.1. The prigorodne services generally represent the majority of the passengers, but the long-distance services carry a greater proportion of the passenger-kilometers. Bus is a major competitor in all countries, as is air for the higher-standard longer-distance services.

Figure 3.2. Railway Traffic in the CIS and Mongolia, 2018



Source: See appendix B for country-level source information.

Box 3.1. Prigorodne Rail Services in the CIS

Many lines in the CIS railways carry a daily or twice-daily passenger service, ordinarily provided by a multiple-unit train, which stops at all stations and effectively acts as a local bus service. In areas where roads are often poor, such services are cheap and reliable, although inevitably serving only a small proportion of the total rural population. In Ukraine, in 2018, such services (known there as priymiske) carried 104 million passengers compared to 47 million on the long-distance services. But because the average trip length on the priymiske services was 47 kilometers, compared to 243 kilometers on the long-distance ones, the priymiske services only represented 17 percent of the total passenger-kilometers.

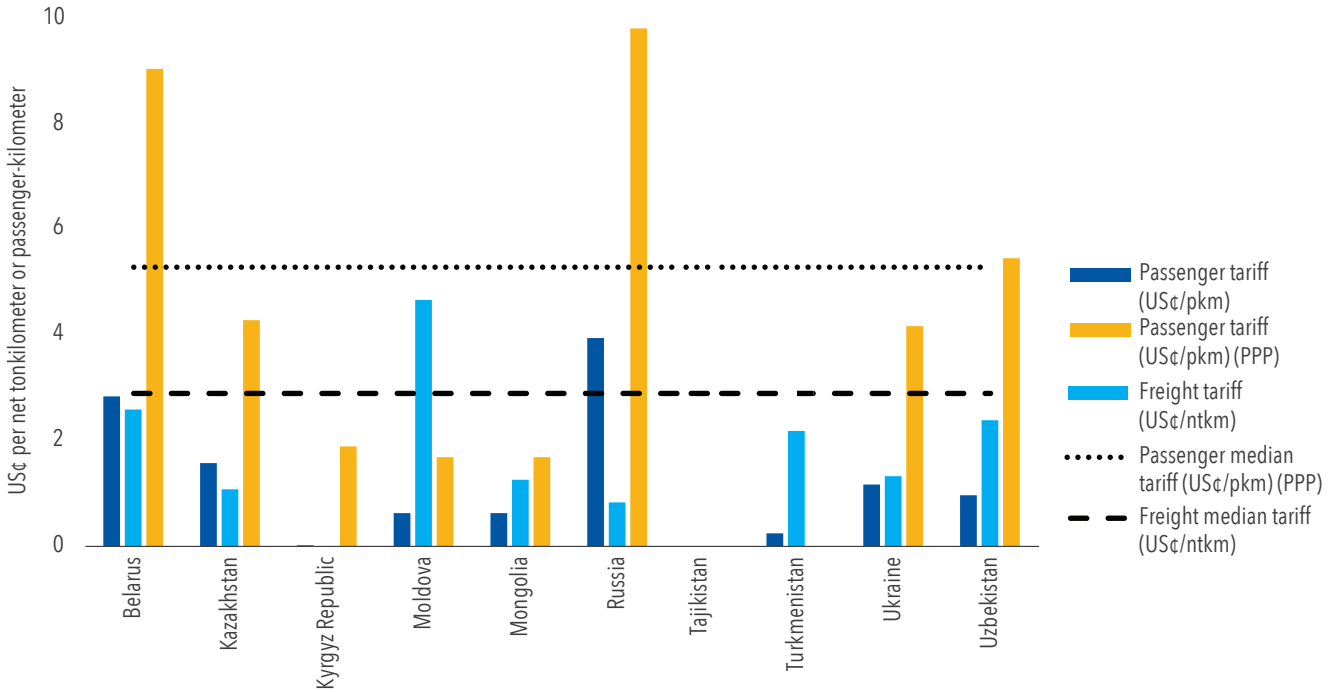
The prymiske services, which are about 80 percent of the train-kilometers in Ukraine, carried an average load in 2018 of about 120 passengers, compared to 330 in the long-distance category, and passengers paid about US$0.005 per passenger-kilometer compared to US$0.013 per passenger-kilometer for the long-distance service. Not surprisingly, the long-distance services recovered half their cost (including infrastructure), and the priymiske recovered barely 10 percent.

Source: World Bank analysis.

Pricing

The passenger fares in figure 3.3 represent systemwide averages over all classes of passengers, heavily weighted toward the standard (or economy) class; they also represent an average of the long-distance (which are predominantly sleeping-car services) and prigorodne services. In all countries, the differential between standard class and upper class is significant, as is the difference between prigorodne and long-distance, as discussed in box 3.1. The average fares in all countries except Russia

Figure 3.3. Average Railway Tariffs in the CIS and Mongolia, 2018



Source: See appendix B for country-level source information.
Note: ntkm = net ton-kilometer; pkm = passenger-km; PPP = purchasing power parity; US¢ = US cent (1/100 of US$1). Average tariffs estimated from passenger and freight revenues, adjusted for nonrail wagon operators. Data not available for Tajikistan or Turkmenistan.

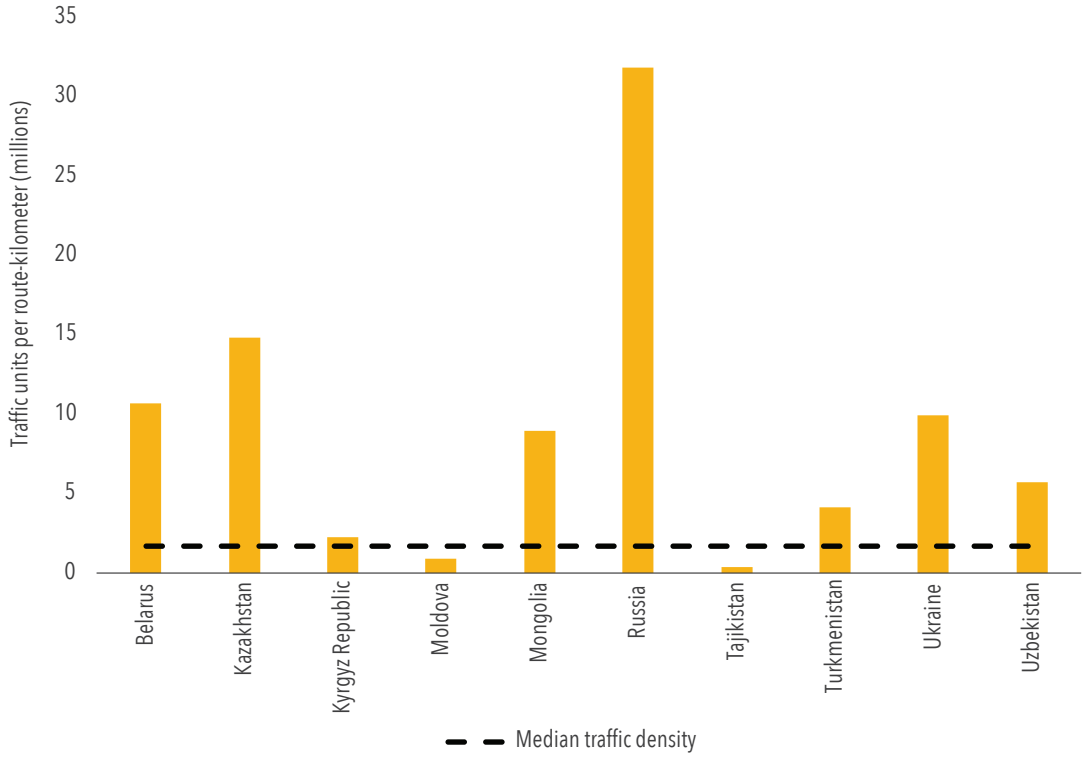
and Belarus are quite low by world standards.[8] Passenger tariffs for standard class in all countries are controlled by the government, and in many cases the only way for the railway to increase the yield is to steadily limit the supply of the cheapest trains and thus encourage passengers to migrate to higher-fare services. Government compensation for the controlled tariffs is provided in Kazakhstan and in Ukraine (in theory[9]), but it is generally rather less than what the railways claim.

Average freight tariffs on the large networks range from US$0.01 to US$0.03 per net ton-kilometer, similar to tariffs on other general-freight railways in comparable countries. Freight tariffs are heavily influenced by the traditional value-based tariff structures, the relative cost of carrying different commodities (as reflected in net tons per wagon roundtrip), direction of travel, and volume, and are generally controlled, at least broadly, by both governments and by CIS-wide agreements for international traffic. Often different tariff exist depending on the nature of the traffic: Domestic tariffs are generally lower, as are export tariffs. Import tariffs are generally somewhat higher, as are transit tariffs, especially if the traffics are captive. Many transit tariffs also have the additional benefit of being denominated in Swiss francs, thus providing at least a partial hedge against currency devaluations.

Traffic density

Traffic density is important because railway infrastructure has relatively high fixed costs and low variable costs. As a result, railway profitability is normally highly correlated with traffic density. Figure 3.4 gives the traffic densities. Four railways have a high network density, at 10 million traffic units[10] or more, although in the case of Mongolia most of the freight is concentrated on a single line. Uzbekistan and Turkmenistan have densities of about 5 million traffic units, but the others have average network densities of 2 million traffic units or less. This is barely enough to fund their own renewals and replacements.

Figure 3.4. Railway Traffic Density in the CIS and Mongolia, 2018



Source: See appendix B for country-level source information.

Productivity

Labor and asset productivity (locomotive and wagon utilization) present a similar picture to network density. Figure 3.5 presents estimated labor productivity for the networks covered in the review.

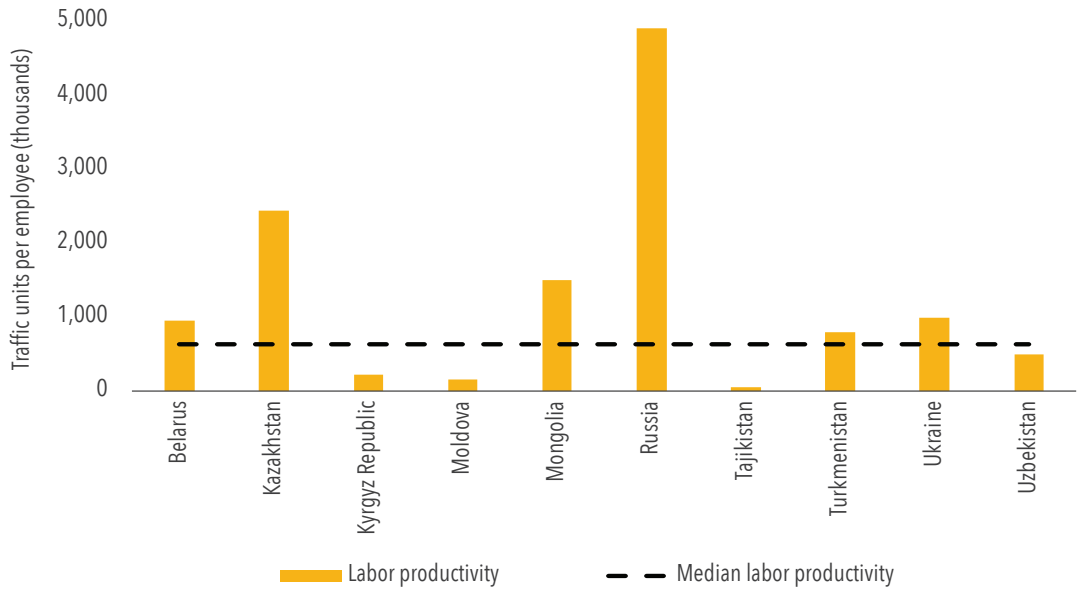
Russia railway has the highest labor productivity, at nearly 5,000 traffic units per employee. However, this figure is somewhat misleading because the staff of freight wagon operators are not included in this figure. Kazakhstan has the next highest labor productivity, at nearly 2.5 million traffic units per employee, reflecting its high proportion of trainload movements as well as its relatively limited passenger services. Mongolia also has high labor productivity, in its case reflecting its very simple network and high volume of bulk movements. Ukraine, Turkmenistan, and Belarus, which all have a mix of traffic types as well as substantial passenger services, have productivities of about 1 million. The smaller railways all have low productivities, a direct reflection of their low of traffic. Kyrgyz Republic and Tajikistan, which function as terminal railways, also have very short average line-haul distance.

Quality of service

It is difficult to find an indicator of quality of service applicable across all railways. If the public is surveyed, their response will inevitably be in terms of passenger service, and this will also be the case with many businesses in the service sector. Manufacturers will consider the quality of the general freight service, either domestically or, more broadly, the handling of import/export shipments. Manufacturers will be primarily concerned with speed and reliability of service, damage, and cargo security. Shippers of bulk traffic will also weight cost as an important factor.

The indicator adopted for this study is the World Economic Forum (WEF) survey on the quality of railroad infrastructure for 2017 and 2018.[11] The quality of railway service covers a wide range of

Figure 3.5. Railway Labor Productivity in the CIS and Mongolia, 2018

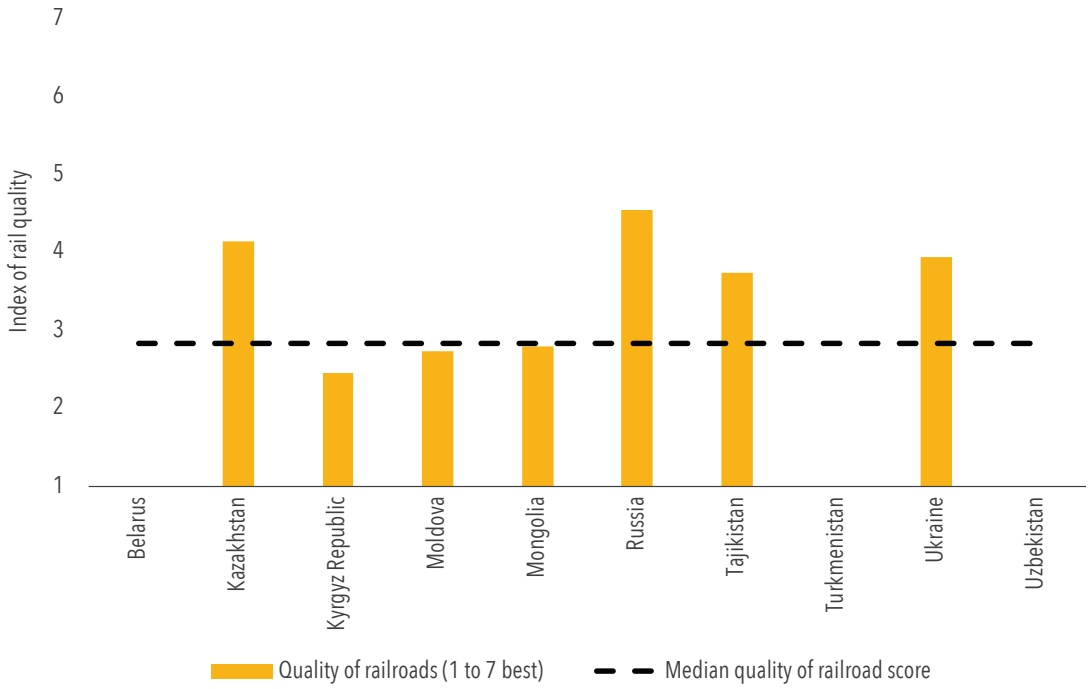


Source: See appendix B for country-level source information.

activities and, because the assessments are done by local businesses, they offer no guarantee of consistency in the scores, although the order of magnitude provides a general guide (see figure 3.6).

To provide some context for these indexes, the Unites States scores 5.48, Germany 5.5, Japan 6.58, and Australia 4.07.

Figure 3.6. Indexes of Rail Quality in the CIS and Mongolia, 2017–2018



Source: WEF 2017.

Notes

1. Two short extensions of the Uzbekistan and Turkmenistan networks, which are not covered in this report, operate over their national borders into Afghanistan.
2. The official name of this railway is the Ulan Bator Railway, but it is often referred to as the Mongolian Railway. It also includes a short network, disconnected from the main line, in eastern Mongolia. Confusingly, the Mongolian government created a separate (and 100 percent Mongolian-owned), which is intended to be a transport operator as well as a constructor of new lines serving the rest of the country. A privately owned mineral railway is also connected to the Ulan Bator Railway network.
3. This term refers to all services within 200 kilometers (and sometimes greater distances), most of which operate once or twice daily along almost every line in the network, generally stopping at all stations.
4. Organisation for Co-operation between Railways (https://en.osjd.org/), a CIS organization similar to the International Union of Railways (https://uic.org).
5. Data taken from the World Bank Private Participation in Infrastructure (PPI) Database (https://ppi.worldbank.org/en/ppi).
6. The Kazakhstan score is taken from the 2018 Organisation for Economic Development and Co-operation (OECD) Database.
7. Seventeen of the networks were in Russia itself. The present Ukraine network consists of six of the previous railways, and the Kazakh network comprises the remaining three railways. By contrast, parts of the Kazakh and Central Asia networks were separated to form the Kyrgyz Republic network, while the remainder of the Central Asia Railway was split to form the separate Uzbekistan, Tajikistan, and Turkmenistan railways.
8. The very low fare in Moldova is for prigorodne services only. International services operate from Moldova to Moscow and St. Petersburg, but these generally carry very few passengers to and from Moldova. Most of these international passengers travel within or between Ukraine and Russia. Without such passengers, these services could not operate, and their revenue has been excluded.
9. The compensation is transferred from the central government to the oblasts, which are then supposed to compensate the railways. However, many oblasts use these funds to support local bus services rather than the prigorodne rail services.
10. Traffic units equal the sum of passenger-kilometers and net ton-kilometers.
11. The Quality of Railroad Infrastructure indicator is one of the components of the Global Competitiveness Index published annually by the World Economic Forum (WEF). It represents an assessment of the quality of the railroad system in a given country based on data from the WEF Executive Opinion Survey, a long-running and extensive survey tapping the opinions of more than 14,000 business leaders in 144 countries. The score for railroad infrastructure quality is based on only one question. The respondents are asked to rate the railroads in their country of operation on a scale from 1 (underdeveloped) to 7 (extensive and efficient by international standards). The individual responses are aggregated to produce a country score.

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WEF (World Economic Forum). 2017. Global Competitiveness Report 2017–2018. Geneva: World Economic Forum. https://www.weforum.org/reports/the-global-competitiveness-report-2017-2018.

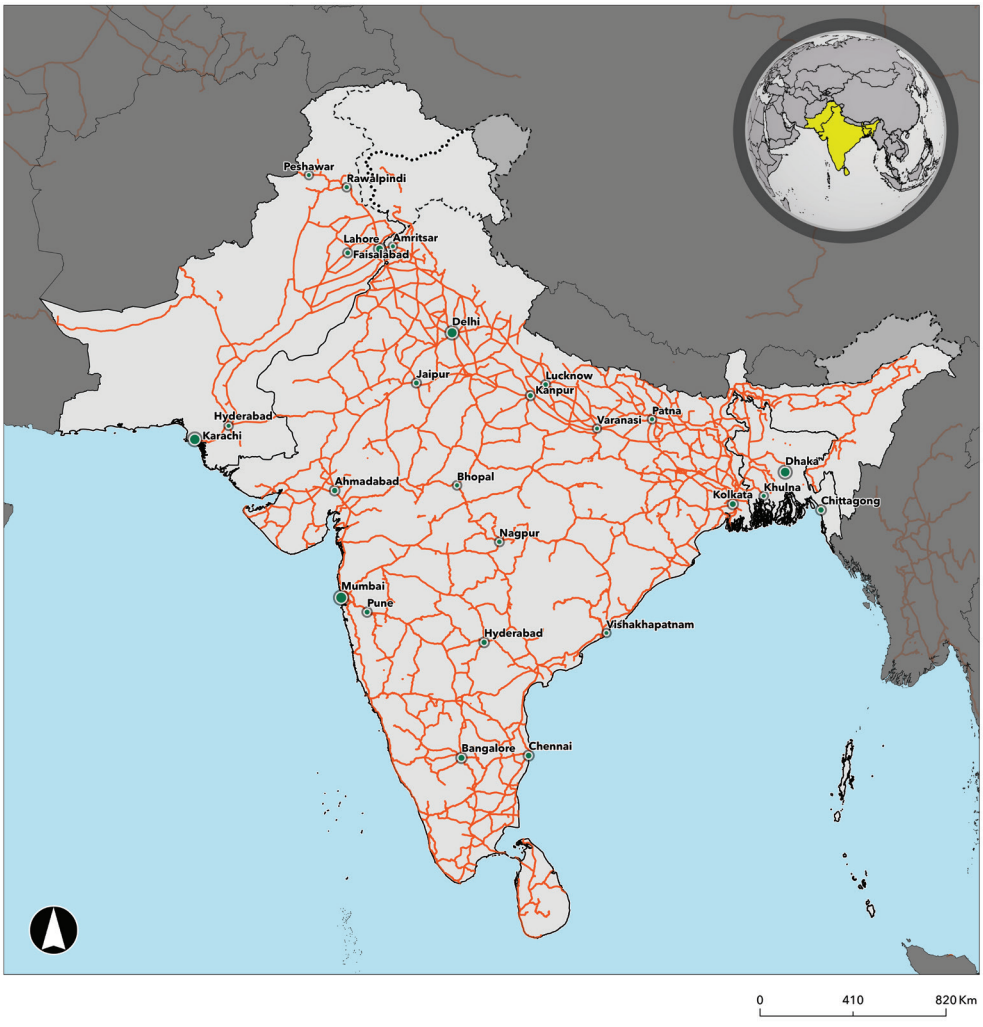
Chapter 4:
Railways in South Asia

Introduction

This chapter presents a brief overview of the current railways in South Asia (India, Pakistan, Sri Lanka and Bangladesh).[1] These countries all have substantial rail networks. Three of the rail networks were originally constructed as a single network by multiple government and private companies, covering all three countries prior to their independence. Particularly in India, several extensions have been made to the network. The networks essentially operate to common technical standards, although the standards are slowly diverging as the systems develop in different ways. The Indian network is by far the largest and is subdivided into 16[2] zonal railways under a Railway Board reporting to the Minister of Railways. The other railways are much smaller, with Pakistan the same size (but with much less traffic) as the largest Indian zonal railway, and Bangladesh smaller than all but four of the Indian zonal railways (map 4.1).

All three mainland railways have significant freight services—although India's traffic is several orders of magnitude greater than that of the other two—with a

Map 4.1. Railways in South Asia



Source: Map produced by the World Bank Geospatial Operations Support Team (GOST).

strong emphasis on traffic to and from the ports and, in India's case, with substantial domestic industrial traffic, especially coal. Sri Lanka, by contrast, handles little freight traffic. All four countries also operate substantial nonurban passenger services. In addition, one of the busiest suburban rail services in the world centers on Mumbai, which represents more than half of India's passengers (but under 10 percent of the passenger-kilometers). Only limited suburban services operate in the other countries.

This chapter summarizes the key characteristics of the railways, as included in the Developing Country Railway Database (appendix A). The data have been collected from railway annual reports. Most data are for 2018. All median figures shown in the graphs reflect the representative sample of railways included in this report and, importantly, the sample does not include some large railway networks, including those in North America, Europe, and China.

Institutional Structure

All railways in South Asia are government owned. Indian Railways is effectively a government department, though with a certain amount of independence from typical departmental practices. In Sri Lanka, the railways are a government department under the Ministry of Transport and Civil Aviation. Both the Pakistan and Bangladesh railways are corporations; however, in both countries, the minister of railways and the government play a large role in their management and funding. None of the four countries has a private railway, although in India several fully government-owned railway corporations (for example, Konkan Railway and Dedicated Freight Corridor Corporation of India, Ltd.) and some railway entities with private sector investors, including Concor and Pipadav railway, exist.

Indian Railways is financially self-sustaining in the sense it can normally finance its own asset renewals and replacements. However, major infrastructure projects are nowadays largely financed by the government, either directly or indirectly. The railways in Pakistan and Bangladesh require government support for both operations and capital expenditures. In all four countries, passenger services contribute little, if anything, to the cost of maintaining the infrastructure, not least because passenger fares have been kept low for many years as a matter of government policy, and the financial gap has to be covered by the freight services. Although India has enough freight traffic to be able to cover this cost, the other three networks have seen their freight traffic steadily erode as roads have been improved and road transport has become more competitive.

Private investment in railway infrastructure has been seen in India only since the early 2000s. In total, five railway projects amounting to a total of US$427 million have been undertaken.[3]

Current Situation

Networks

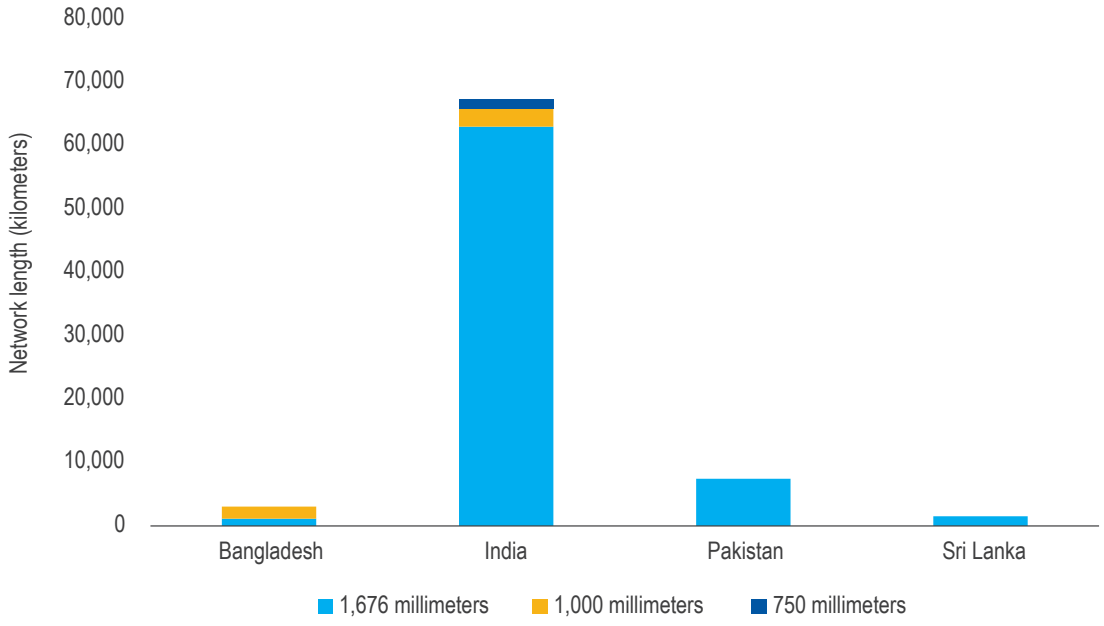
Railway development followed a similar pattern in all four South Asian countries, with lines heading inland from ports (initially Mumbai and Kolkata, but later Karachi, Colombo, and Chittagong) to reach a trading center, and branch lines were then built to serve developing areas. However, as India was at that time a single administrative entity, cross-continent main lines were built linking Kolkata, Mumbai, Chennai, Delhi and Lahore. Physically, several links between the three mainland networks have been inherited from pre-independence, but the only one with any significant traffic is between India and Bangladesh. No links connect to other countries in Southeast Asia, and only one substandard link carrying little traffic exists between Pakistan and Iran.

At the end of 2019, the operating public networks in South Asia totaled nearly 80,000 kilometers. The Indian network is by far the largest (67,000 kilometers), with 7,700 kilometers in Pakistan, nearly 3,000 kilometers in Bangladesh, and nearly 1,500 kilometers in Sri Lanka (figure 4.1).

In Pakistan and Sri Lanka, the entire operating network is now 1,676 millimeters, but both Bangladesh[4] and India still have a small amount of meter-gauge rail. There are also some small narrow-gauge networks in India, such as the so-called "toy trains," such as Darjeeling and Shimla. At independence, about half of India's then-55,000-kilometer network was meter gauge, but almost all of this has been progressively converted—especially since Project Unigauge began in 1992—and now only a few branch lines remain. The broad-gauge network in Bangladesh is also being extended, normally by converting meter gauge to mixed gauge.

Much of the Indian network, and some of the other three networks, has been upgraded significantly over the years, including duplication, electrification, and modern signaling. No high-speed passenger lines are yet operational, though

Figure 4.1. Railway Route-Kilometers in South Asian Countries, 2018



Source: See appendix B for country-level source information.
Note: In Bangladesh, the total length of 1,110 kilometers (under 1,676 millimeters) includes 433 kilometers of dual gauge, which allows both broad-gauge and meter-gauge trains to run there.

Box 4.1. Suburban Railways in Mumbai, India

Mumbai has one of the largest and most heavily used suburban railways in the world. The commercial center of Mumbai is at the end of a small peninsula, accessed only through its northern end. Three main routes transit this peninsula: one coming 60 kilometers from due north (known as the Western line); one coming 60 kilometers from the northeast, which subsequently splits into two lines going north and south; and one coming from Navi Mumbai (the Harbour line). The total length of the network is about 400 kilometers, and it carries more than 8 million passengers each day. Both the Central and Western lines are largely quadrupled, with the Western line also having sections with six tracks. Trains in the peak hours are extremely crowded, with passenger densities of 12 or more per square meter, and a single train, with up to 15 carriages, can carry upwards of 5,000 passengers. The average distance traveled is more than 30 kilometers, and metro lines are being constructed to deal with shorter trips.

Mumbai carries about 64 percent of the suburban passengers in India. Kolkata also has a substantial demand, carrying about 1 billion passengers per annum, with an average trip length of 35 kilometers, and Chennai carries 400 million passengers per annum about the same distance.

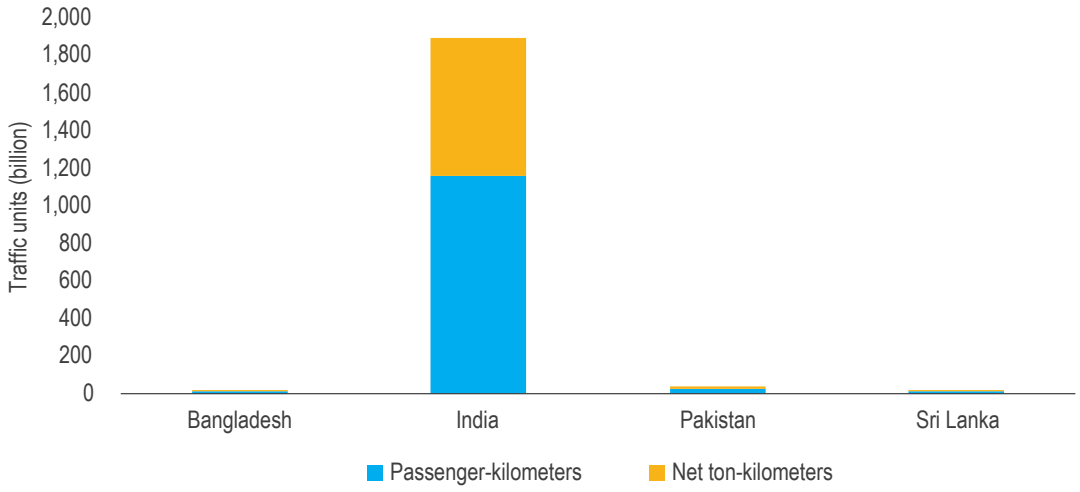
Source: World Bank analysis.

India is constructing a line between Mumbai and Ahmedabad and new dedicated high-capacity freight lines linking eastern India with Delhi and the Punjab as well as Delhi and Mumbai. Significant suburban networks service Mumbai, Kolkata, and Chennai, but the network in Mumbai is by far the most important (box 4.1). The main-line infrastructure in all three countries is generally in good condition, although some secondary lines, and many branch lines, are maintained to lower standards, with speed restrictions over long sections. Signaling ranges from very modern systems on the high-density lines to much simpler and older systems on lower-density lines.

Traffic

In total, the four South Asian railways annually carry nearly 750 billion net ton-kilometers of freight and more than 1,200 billion passenger-kilometers. India has by far the most important railway, both for passengers and for freight (figure 4.2). The largest single traffic item for India is coal (about 50

Figure 4.2. Railway Traffic in South Asian Countries, 2018



Source: See appendix B for country-level source information.

percent of the total) for power stations, steel plants, and other industrial uses, while other traffic items associated with steel plants and cement represent an additional 17 percent and 10 percent, respectively. Other bulk commodities contribute an additional 15 percent, leaving about 100 million tons of general freight, about half of which is containerized freight facing strong competition from road haulage.

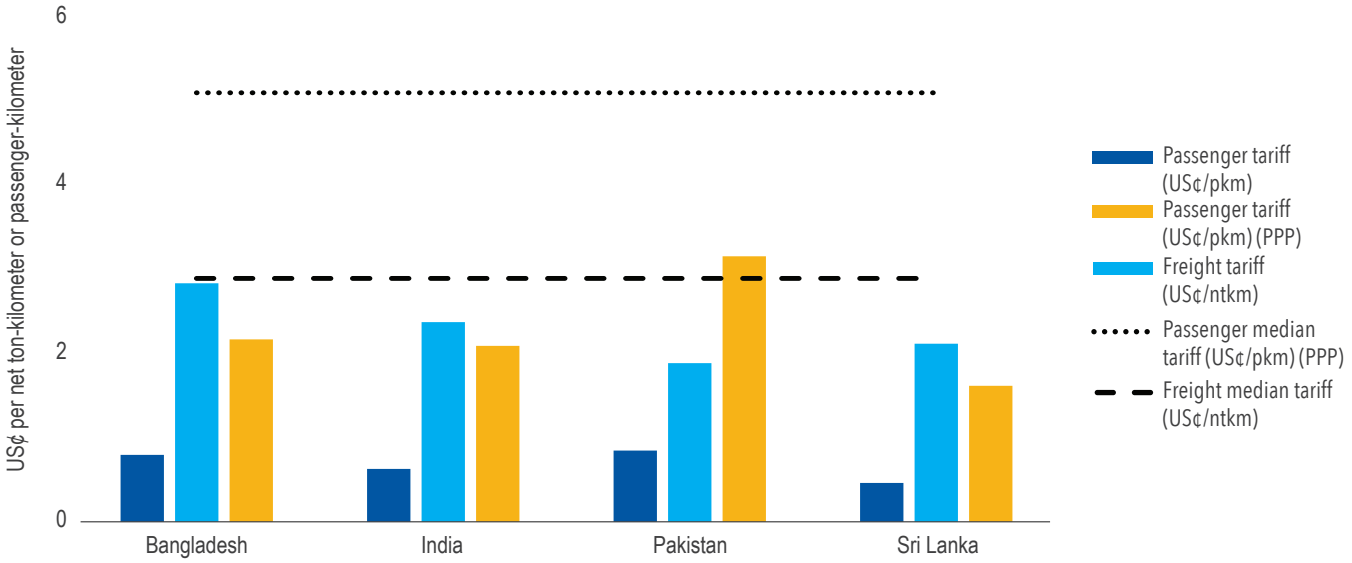
Pakistan and Bangladesh carry only a limited amount of freight, and Sri Lanka almost nothing. In Pakistan, all the coal-burning power stations are on the coast and supplied by sea or by short-haul movements, and the only part of Bangladesh located within a reasonable distance from the sea is almost entirely agricultural. Road competition in Pakistan is particularly strong, and railway management has struggled to provide an attractive service despite the main freight generating area, approximately 1,000 kilometers from the port.

All four countries provide relatively high-frequency long-distance passenger services between the major population centers. But the frequency of trips (trips per capita) in India and Sri Lanka is at least 10 times that in Pakistan and Bangladesh. Air travel is a major competitor in both India and Pakistan.

Pricing

Nonurban passenger services face strong competition from buses in Sri Lanka, Pakistan, and Bangladesh in terms of price and of service frequency, and from air in both India and Pakistan in terms of travel time. The passenger fares in figure 4.3 are systemwide averages over all classes of passengers. In all countries, the differential between standard class and upper class is significant. The average fares are all low by developing country standards with average yields (revenue per passenger-kilometer) US$0.02 to US$0.03, adjusted for purchasing power parity. Passenger tariffs in all four countries are tightly controlled by the government. For the foreseeable future the only way to increase the yield will be to alter the mix of services to reduce the lowest price offerings and encourage passengers to migrate to higher-fare services.

Figure 4.3. Average Railway Tariffs in South Asian Countries, 2018



Source: See appendix B for country-level source information.
Note: ntkm = net ton-kilometer; pkm = passenger-km; PPP = purchasing power parity; US¢ = US cent (1/100 of US$1).

Average freight tariffs on the major networks range from US$0.02 to US$0.03 per net ton-kilometer, rather lower than the median developing country tariffs of US$0.029 per net ton-kilometer. Tariffs are generally constrained by competition, principally from road or in some cases from alternative routes and are also influenced by the traditional value-based tariff structures, the relative cost of carrying different commodities (as reflected in net tons per wagon roundtrip), direction of travel, and volume. Freight tariffs are also controlled by governments, although increases are more common to support the internal cross-subsidy between the freight and passenger businesses.

Traffic density

Traffic density is important because railway infrastructure has relatively high fixed costs and low variable costs. As a result, railway profitability is normally highly correlated with traffic density. Figure 4.4 gives the traffic densities on the nonurban sections of the networks, that is, excluding the suburban traffic, which is particularly high in India. India has the highest network density, at 26 million traffic units.[5] India's is one of the highest network densities in the world, second only to those of China and Russia among general-purpose railways.

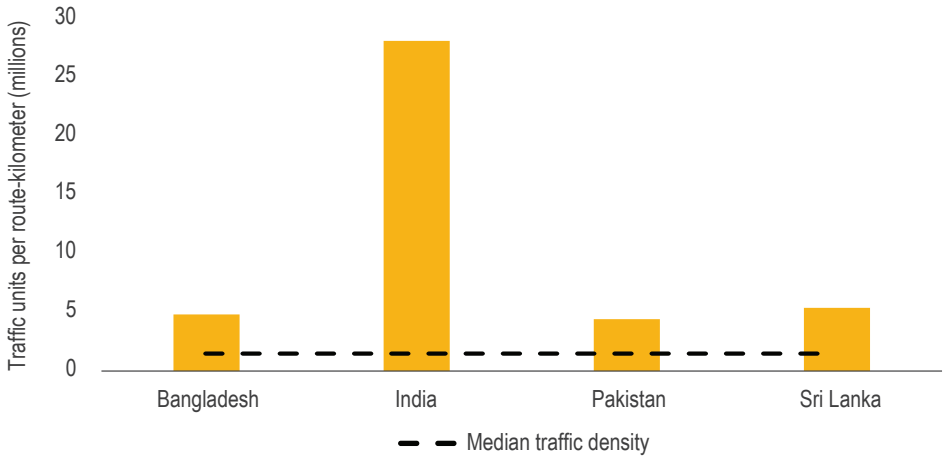
Pakistan, Sri Lanka, and Bangladesh all have average network densities of nearly 5 million traffic units, normally enough to enable them to fund their own renewals and replacements. However, the traffic on these networks is overwhelmingly passengers, and the low passenger tariffs mean the variable costs of passenger operation are only covered in a few services, and the high volume does not translate into profits that could then be used for asset replacement.[6]

Productivity

Labor and asset productivity (locomotive and wagon utilization) present a similar picture to network density. Figure 4.5 presents estimated labor productivity for the four networks.

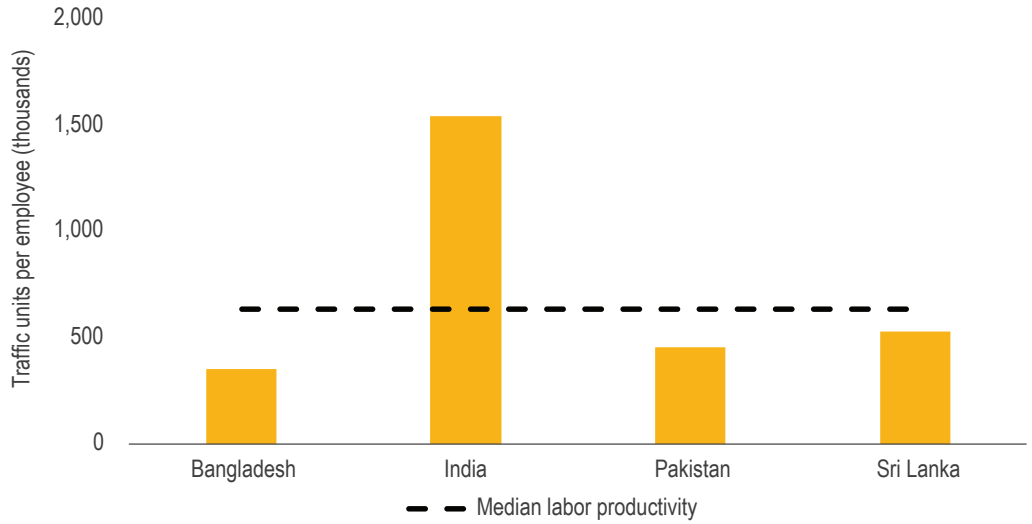
India has the highest labor productivity at just more than 1.5 million traffic units per employee, reasonably good for a general railway with a very substantial passenger business. The other three countries all generate under 500,000 traffic units per employee, relatively low for major railways, likely in part due to the much lower level of investment in assets over the last 40 years, with many labor-intensive maintenance and traffic management practices still surviving.

Figure 4.4. Railway Traffic Density in South Asian Countries, 2018



Source: See appendix B for country-level source information.

Figure 4.5. Railway Labor Productivity in South Asian Countries, 2018



Source: See appendix B for country-level source information.

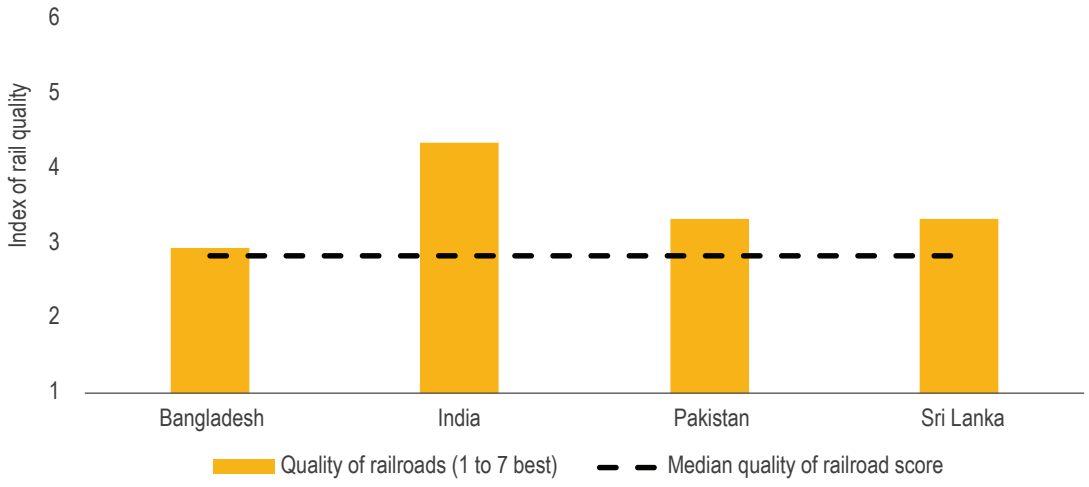
Quality of service

It is difficult to find an indicator of quality of service applicable across all railways. If the public is surveyed, their response will inevitably be in terms of passenger service, and this will also be the case with many businesses in the service sector. Manufacturers will consider the quality of the general freight service, either domestically or, more broadly, the handling of import/export shipments. Manufacturers will be primarily concerned with speed and reliability of service, damage, and cargo security. Shippers of bulk traffic will also weight cost as an important factor.

The indicator adopted for this study is the World Economic Forum (WEF) survey on the quality of railroad infrastructure for 2017 and 2018.[7] The quality of railway service covers a wide range of activities and, because the assessments are done by local businesses, they offer no guarantee of consistency in the scores, although the order of magnitude provides a general guide (see figure 4.6).

India scores reasonably well, at 4.4, while the other three networks are around 3.0. To provide some context for these indexes, the Unites States scores 5.48, Germany 5.5, Japan 6.58, and Australia 4.07.

Figure 4.6. Indexes of Rail Quality in South Asian Countries, 2017–2018



Source: WEF 2017.

Notes

1. Two short extensions (34 kilometers) of the Indian network operate over the border from India into Nepal. These are not included in this review.
2. Together, these 16 zonal railways form the mainline zones. The small metro railway in Kolkata is also technically classified as a zonal railway.
3. The total amount excludes all private investments in metro systems. Data from the World Bank Private Participation in Infrastructure (PPI) Database (https://ppi.worldbank.org/en/ppi).
4. Bangladesh operates a small quantity of mixed-gauge railways.
5. Traffic units equal the sum of passenger-kilometers and net ton-kilometers.
6. Other factors contribute to the poor finances of the railway networks for these three South Asian countries, but the low passenger tariffs is one of the most important.
7. The Quality of Railroad Infrastructure indicator is one of the components of the Global Competitiveness Index published annually by the World Economic Forum (WEF). It represents an assessment of the quality of the railroad system in a given country based on data from the WEF Executive Opinion Survey, a long-running and extensive survey tapping the opinions of more than 14,000 business leaders in 144 countries. The score for railroad infrastructure quality is based on only one question. The respondents are asked to rate the railroads in their country of operation on a scale from 1 (underdeveloped) to 7 (extensive and efficient by international standards). The individual responses are aggregated to produce a country score.

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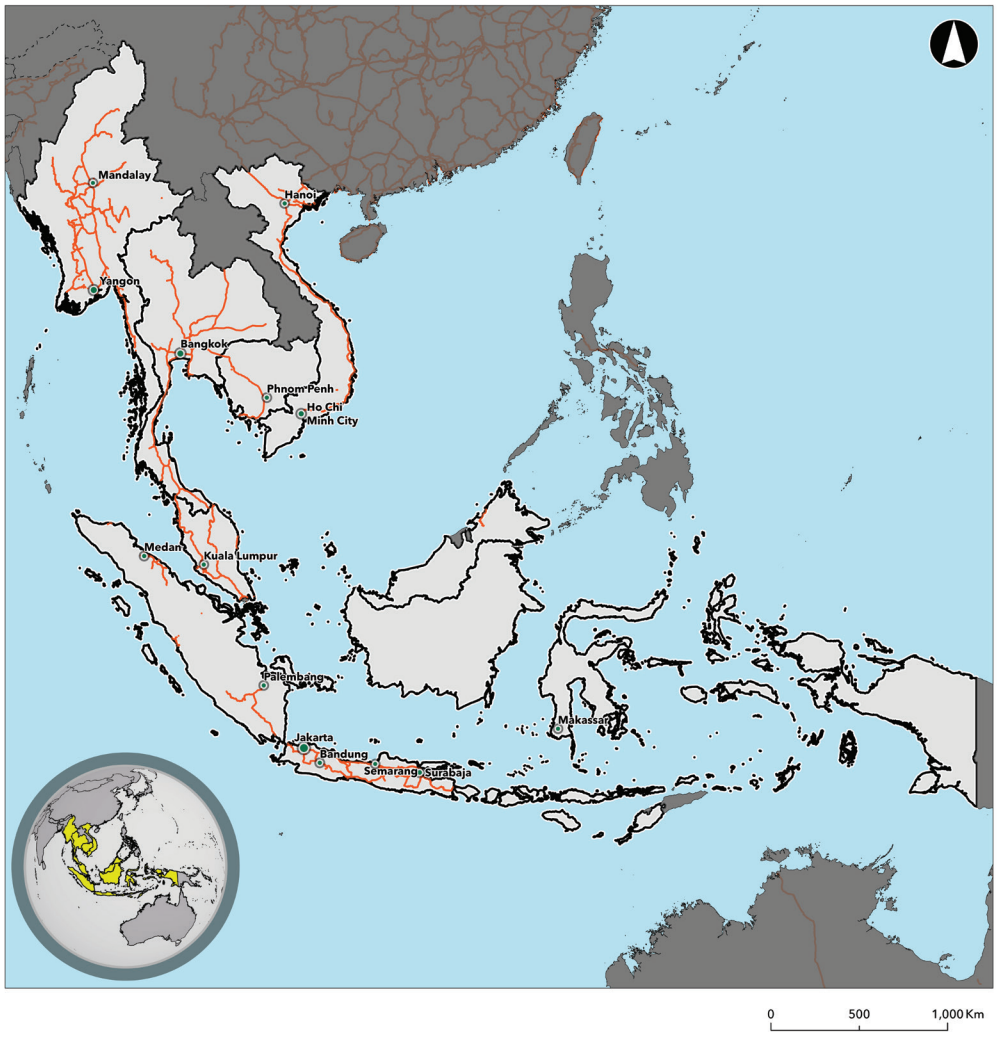
Chapter 5:
Railways in Southeast Asia

Introduction

This chapter presents a brief overview of the railways currently operating in Southeast Asia (Cambodia, Indonesia, Malaysia, Myanmar, Thailand, and Vietnam).[1] Most have substantial rail networks, but until recently only those of Thailand and Malaysia/Singapore were connected, and these were always under different administrations. Most were developed by their governments, although Indonesia had several private railways until after independence (map 5.1). Vietnam also has a substantial private rail network owned by Vincomin, the state-owned coal producer, which transports coal from the production areas in northern Vietnam to adjacent ports.

All the railways provide passenger services. Most have substantial patronage, including a large commuter service in Jakarta and smaller ones in Kuala Lumpur, Yangon, and Bangkok. Indonesia has a substantial freight business, based on coal transport. All railways carry a relatively small volume of general freight.

Map 5.1. Railways in Southeast Asia



Source: Map produced by the World Bank Geospatial Operations Support Team (GOST).

This report summarizes the key characteristics of the railways, as included in the Developing Country Railway Database (appendix A). The data have been collected from various public sources—annual railway or regulator reports and/or national statistical annuals. Most data are for 2018. All median figures shown in the graphs reflect the representative sample of railways included in this report and, importantly, the sample does not include some large railway networks, including those in North America, Europe, and China.

Institutional Structure

All the railways in Southeast Asia, except the network in Cambodia, are now government owned, and other than in Myanmar, these are all state-owned enterprises. A stand-alone coal railway is under construction in Kalimantan in Indonesia. Myanmar's railway remains effectively a government department. In Cambodia, the rail network and operations have been concessioned following reconstruction. Thailand has recently separated the regulatory function from the State Railway of Thailand (SRT) and made it the responsibility of the revival of the Department of Rail Transport (DRT)—a government agency under the Ministry of Transport. DRT oversees all rail transport in Thailand, including urban rail. SRT remains the railway operator for all intercity networks.

None of the railways is financially self-sustaining, or able to finance their own asset renewals and replacements. All major infrastructure projects and renewal are funded by government either directly or indirectly. Passenger fares in many countries are kept low by government policy and contribute little, if anything, toward the cost of maintaining the infrastructure. However, this constraint often applies only to the lowest class of travel, and several systems have introduced higher-standard services that allow higher fares to be charged. Nevertheless, profits from passenger services are insufficient to cover the infrastructure costs, and freight volumes are insufficient for freight profits to cover the deficit.

Vietnam, which has an unusual institutional structure, has the only railway that allows third-party access. The infrastructure is owned by the government (through the Vietnam Rail Authority, or VRA) but is maintained by third-party contractors supervised by the Vietnam Railways (VNR). The funds for this maintenance are a combination of support from the government and access charges paid by the users. In theory, any operator can use the railway once it has been licensed by VRA, but mainline operations are undertaken by two subsidiaries of VNR, one concentrating on freight services and one on passenger services, which in theory are self-financing. This structure began operating in 2018 and replaced one in which two enterprises both operated passenger and freight services and were originally intended to provide more competitive services in terms of quality; in practice, they largely competed between themselves on price.

In the Southeast Asia region, private investment in the railways has been seen only in Indonesia (a high-speed rail project connecting Jakarta to Bandung for a total of US$6 billion, with a 40 percent investment by a private partner), Thailand (high-speed rail linking Don Mueang Airport with Suvarnabhumi Airport, and the U-Tapao Airport, for a total of about US$7.2 billion), and Malaysia (a US$269 million contract to build and operate the Kuala Lumpur Sentral Station).[2]

Current Situation

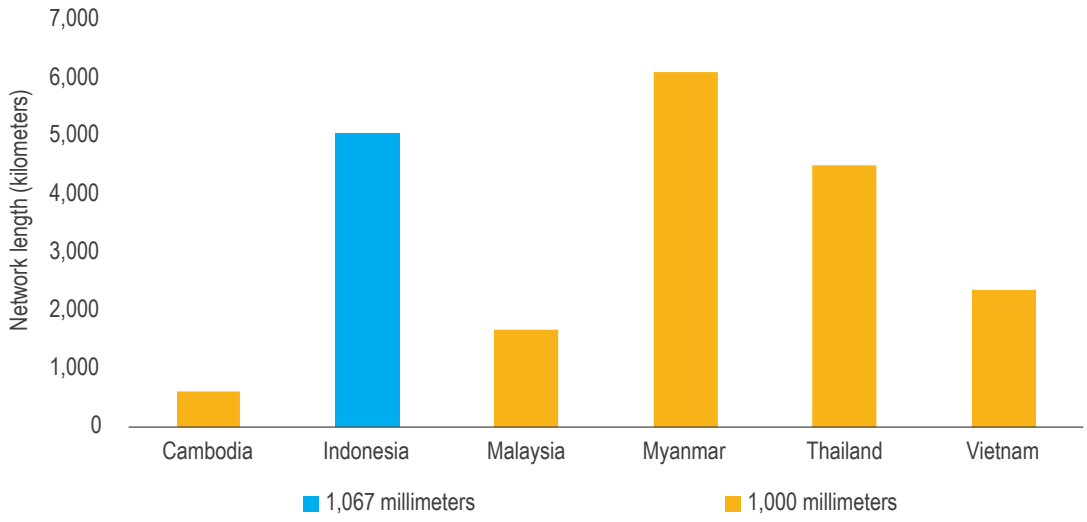
Networks

Railway development, as in many countries, spread initially to and from ports. But, with the Malayan peninsula and Java both being narrow, lines were then constructed in both countries that ran parallel to the coasts. Eventually, railways linked the Thai and Malaysian networks, and now also links run between Thailand and Cambodia as well as Laos. The western link between Malaysia and Thailand has carried significant freight flows, much of it exports from southern Thailand going to Port Klang and Penang Port in Malaysia, and it still provides an international passenger service through connecting services at the border. The Vietnam network has two links with China, but the combined cross-border volumes are under 1 million tons. A through-passenger service operates on one link and connecting services on the other. There have also been long-standing plans to link the Vietnamese and Cambodian networks. China is currently constructing a line south from China to link with the line from Vientiane in Laos to Thailand and also has plans to promote the construction of an east-west line across Myanmar to access a new Chinese-built port being constructed on the Indian Ocean coast of Myanmar.

At the end of 2019, the operating public networks in South East Asia totaled about 20,000 kilometers. The Myanmar network is the largest (6,000 kilometers), with 5,000 kilometers in Indonesia and 4,000 kilometers in Thailand (figure 5.1). All except Indonesia's networks are meter gauge, with Indonesia's being Cape gauge (1,067 millimeters).

Much of the Indonesian, Malaysian and Thai networks have been upgraded significantly over the years, including line doubling, electrification, and modern signaling. The Cambodian network was also completely reconstructed prior to its concessioning. Myanmar has had some major reconstruction/upgrading schemes funded by multilateral and (predominantly) bilateral aid. No high-speed passenger lines exist as such, although one is being planned to link Singapore and Kuala Lumpur, and another is under construction between Jakarta and

Figure 5.1. Railway Route-Kilometers in Southeast Asian Countries, 2018–2019



Source: See appendix B for country-level source information.

Box 5.1. Suburban Railways in Jakarta, Indonesia

Jakarta is a heavily congested city in which the commercial and administrative centers are located north of the urban area. Suburban services have been operated for several decades, linking these centers with surrounding urban areas, currently coalescing into a single large metropolis. The busiest line links central Jakarta with Bogor, 60 kilometers to the south, but three other main lines stretch to the west, southwest, and west. The lines are shared, to some extent, with mainline passenger services and freight services. The network carries about 1 million passengers each day

Source: World Bank analysis.

Bandung in Indonesia. Significant suburban networks operate in Jakarta (box 5.1), Yangon, Kuala Lumpur, and Bangkok as well as some smaller cities in Indonesia.

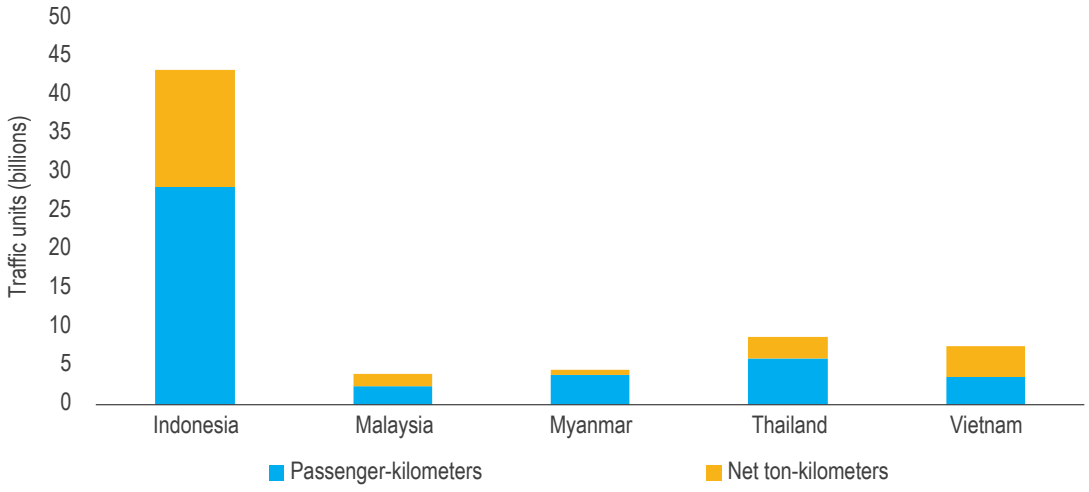
The mainline infrastructure in all systems other than Myanmar's is generally in reasonable condition, although some secondary lines are maintained to lower standards with resultant speed restrictions. Signaling ranges from very modern systems on the high-density lines to much simpler and older systems on lower-density lines. After many years of remaining almost as it had been in 1930, the size of the Myanmar network was doubled between 1990 and 2017, with many lines being built in the more underdeveloped regions of the country. However, many of them were built to very low standards, using local manual labor, and have since proved difficult to operate.[3]

Traffic

In total, the railways annually carry 24 billion net ton-kilometers of freight and nearly 50 billion passenger-kilometers. Indonesia has by far the most important railway, for both passengers and freight (figure 5.2). The largest single traffic item for Indonesia is coal (about two-thirds of the total) for power stations, followed by cement, oil products, containers, and palm oil.

With few bulk minerals and long coastlines by which

Figure 5.2. Railway Traffic in Southeast Asian Countries, 2018–2019



Source: See appendix B for country-level source information.
Note: Data not available for Cambodia.

commodities such as oil products can be easily distributed by sea, the other countries carry only a limited amount of freight. In Malaysia, about half the traffic is shipping containers to and from Port Klang, with much of the rest being cement. Road competition to all of these railways is very strong.

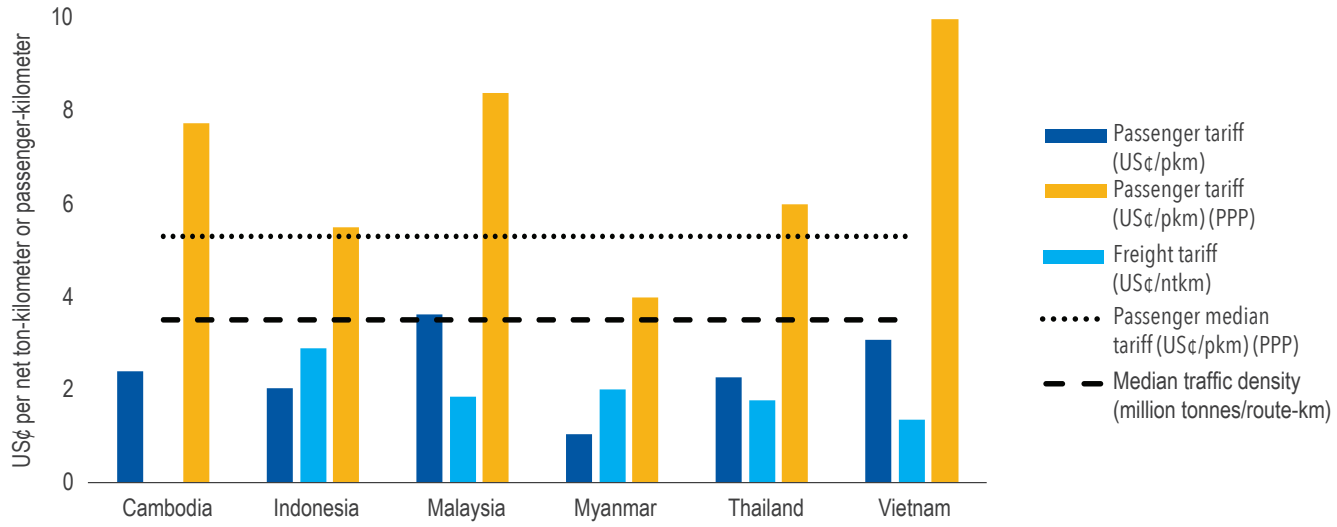
Most countries provide relatively high-standard long-distance passenger services between the major population centers. Air travel is a major competitor in both Indonesia and Vietnam for the longer-distance services, as is bus in all countries.

Pricing

Nonurban passenger services face strong price and service competition from buses in all Southeast Asian countries. The passenger fares in figure 5.3 are systemwide averages over all classes of service, heavily weighted toward the standard (or economy) class. In all countries, the differential between standard class and upper class is significant. The average fares in Myanmar are low by global standards, when considered on a purchasing power parity (PPP) basis but reflect the rollingstock quality and relatively slow speed. Malaysia and Vietnam have average yields (revenue per passenger-kilometers) on a PPP basis of US$0.08 to US$0.10, which are comparable to the yields of many European countries. Passenger tariffs for standard class in all countries are controlled by the government. For the foreseeable future the only way to increase the yield will be to alter the mix of services to reduce the lowest price offerings and encourage passengers to migrate to higher-fare services.

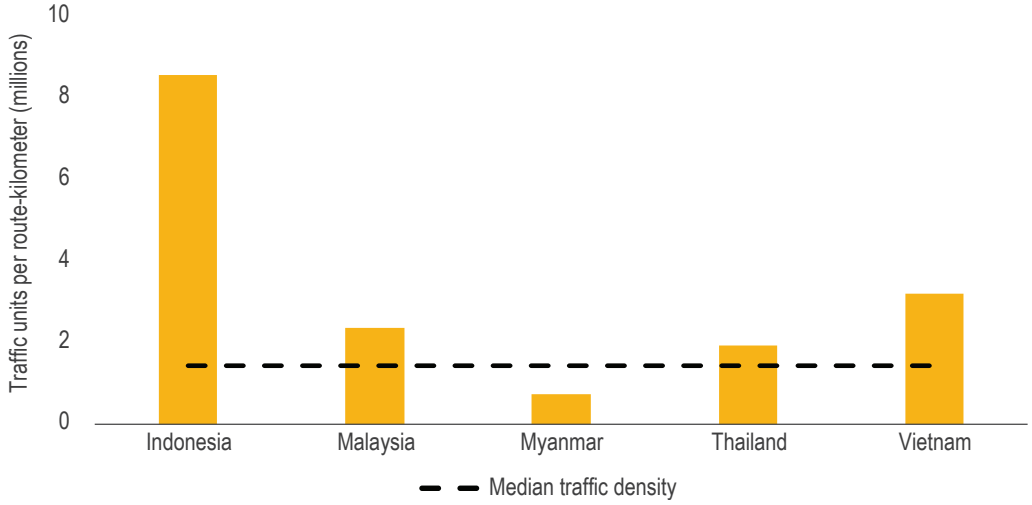
Average freight tariffs on the major networks range from US$0.01 to US$0.03 per net ton-kilometer, rather lower than tariffs on other general-freight railways in comparable countries. Other than those for Indonesian coal traffic, tariffs are generally constrained by competition, principally from road-based transport. Tariffs are also influenced by the traditional value-based tariff structures, the relative cost of carrying different commodities (as reflected in net tons per wagon roundtrip), direction of travel, and volume. Freight tariffs are also controlled by governments, although increases are more common to support the internal cross-subsidy between the freight and passenger businesses.

Figure 5.3. Average Railway Tarrifs in Southeast Asian Countries, 2018–2019



Source: See appendix B for country-level source information.
Note: ntkm = net ton-kilometer; pkm = passenger-km; PPP = purchasing power parity; US¢ = US cent (1/100 of US$1). Freight tariff information for Cambodia not available.
Note: Data not available for Cambodia.

Figure 5.4. Railway Traffic Density in Southeast Asian Countries



Source: See appendix B for country-level source information.
Note: Data not available for Cambodia.

Traffic density

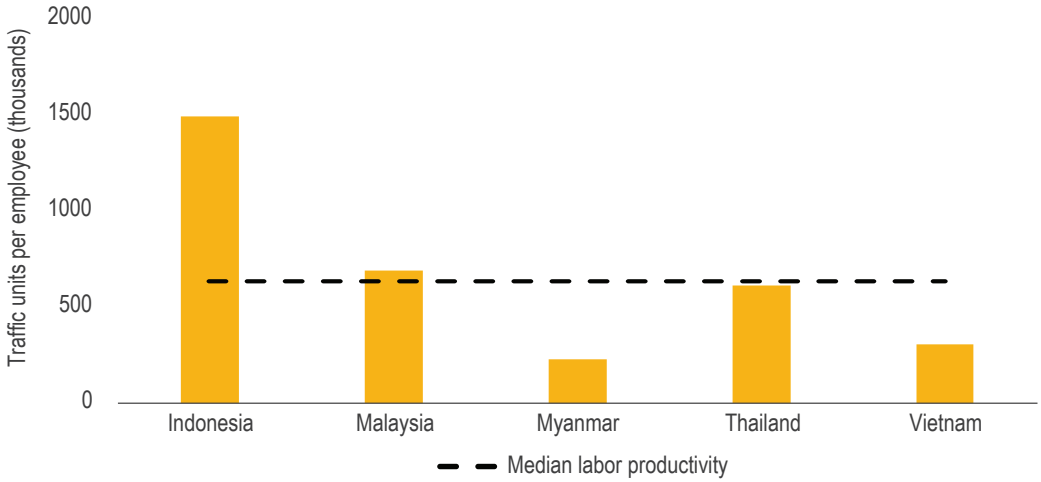
Traffic density is important because railway infrastructure has relatively high fixed costs and low variable costs. As a result, railway profitability is normally highly correlated with traffic density. Figure 5.4 shows the traffic densities. Indonesia has the highest network density, at more than 8 million traffic units,[4] although most of the freight is concentrated on a single line. None of the others have an average network density greater than 3 million traffic units. This is barely enough to fund infrastructure renewals and replacements.

Productivity

Labor and asset productivity (locomotive and wagon utilization) present a similar picture to that of network density. Figure 5.5 presents estimated labor productivity for the Southeast Asian rail networks.

Indonesia has the highest labor productivity at just over 1.5 million traffic units per employee—very good for a railway with a substantial passenger business. Thailand and Malaysia also have reasonable productivities; however, both Vietnam and Myanmar produce well under 500,000 traffic

Figure 5.5. Railway Labor Productivity in Southeast Asian Countries, 2018–2019



Source: See appendix B for country-level source information.
Note: Data not available for Cambodia.

units per employee, although this is in part due to their much lower level of investment in assets over the last 40 years.

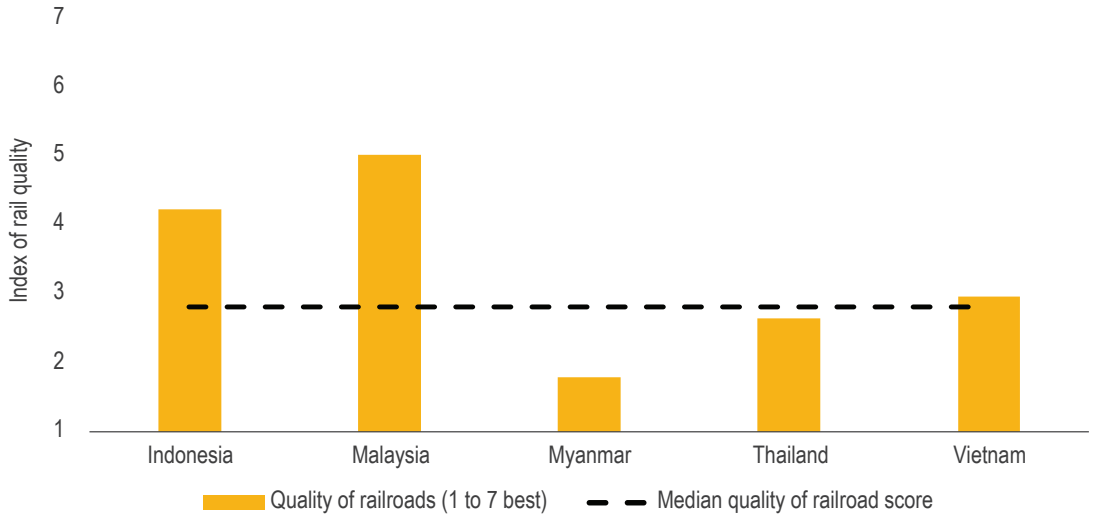
Quality of service

It is difficult to find an indicator of quality of service applicable across all railways. If the public is surveyed, their response will inevitably be in terms of passenger service, and this will also be the case with many businesses in the service sector. Manufacturers will consider the quality of the general freight service, either domestically or, more broadly, the handling of import/export shipments. Manufacturers will be primarily concerned with speed and reliability of service, damage, and cargo security. Shippers of bulk traffic will also weight cost as an important factor.

The indicator adopted for this study is the World Economic Forum (WEF) survey on the quality of railroad infrastructure for 2017 and 2018.[5] The quality of railway service covers a wide range of activities and, because the assessments are done by local businesses, they offer no guarantee of consistency in the scores, although the order of magnitude provides a general guide (see figure 5.6).

To provide some context for these indexes, the Unites States scores 5.48, Germany 5.5, Japan 6.58, and Australia 4.07.

Figure 5.6. Indexes of Rail Quality in Southeast Asia Countries, 2017–2018



Source: WEF 2017.
Note: Data for Myanmar is from 2015–16. Data not available for Cambodia.

Notes

1. Two short extensions of the Thai network and the Malaysian networks operate over their borders into Laos and Singapore respectively. Neither is included in this review, nor is the new line currently being constructed south from China into Laos. Additional small railways operate in the Philippines and Sabah, which are also not included.
2. The totals exclude all PPI investments for metros. Data from the World Bank Private Participation in Infrastructure (PPI) Database (https://ppi.worldbank.org/en/ppi). The data for Thailand comes from an Eastern Economic Corridor (EEC) Office news release (https://www.eeco.or.th/en/news/signing-ceremony-program-of-public-private-partnership-ppp-agreement-the-high-speed-rail-linking-three-airports-project).
3. Some lasted only a few weeks before services were suspended, and one or two never even saw a revenue-earning service.
4. Traffic units equal the sum of passenger-kilometers and net ton-kilometers.
5. The Quality of Railroad Infrastructure indicator is one of the components of the Global Competitiveness Index published annually by the World Economic Forum (WEF). It represents an assessment of the quality of the railroad system in a given country based on data from the WEF Executive Opinion Survey, a long-running and extensive survey tapping the opinions of more than 14,000 business leaders in 144 countries. The score for railroad infrastructure quality is based on only one question. The respondents are asked to rate the railroads in their country of operation on a scale from 1 (underdeveloped) to 7 (extensive and efficient by international standards). The individual responses are aggregated to produce a country score.

References

WEF (World Economic Forum). 2017. Global Competitiveness Report 2017–2018. Geneva: World Economic Forum. https://www.weforum.org/reports/the-global-competitiveness-report-2017-2018.

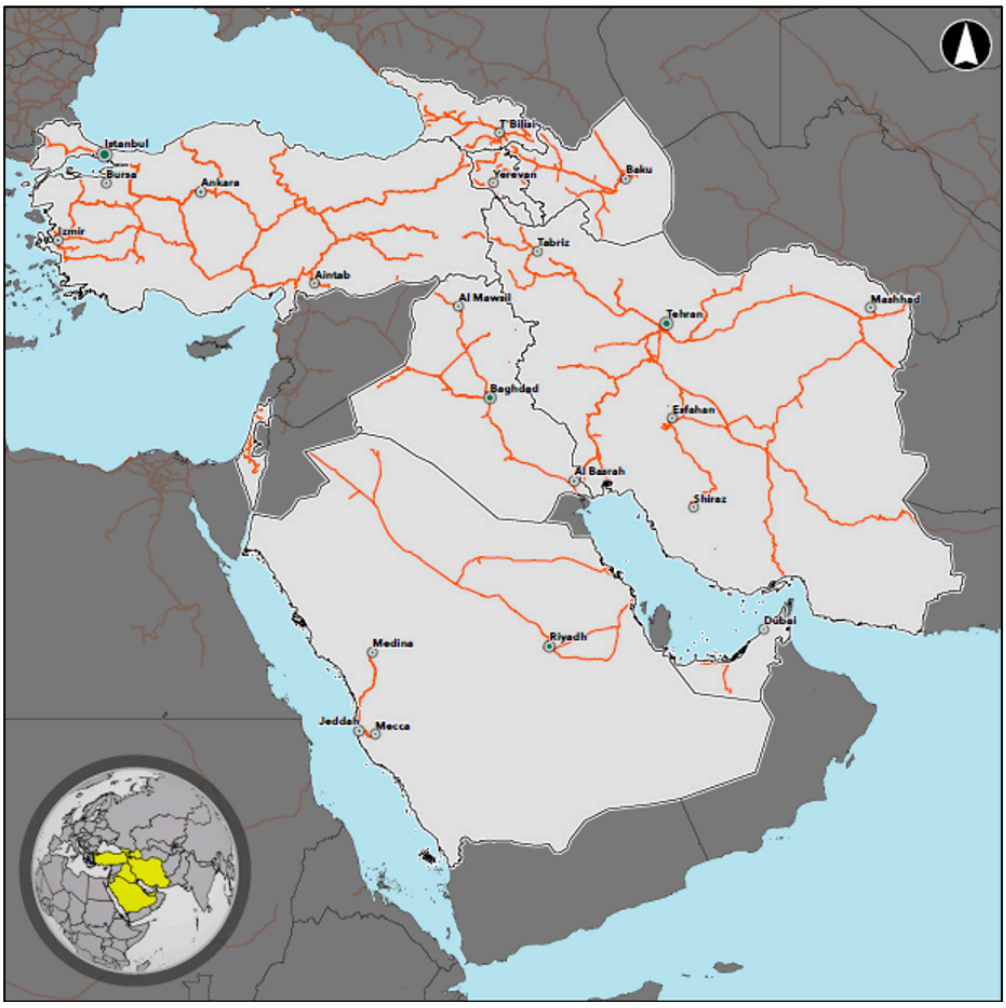
Chapter 6:
Railways in the Middle East, Caucasus, And Turkey

Introduction

This chapter presents a brief overview of the current railways in the Middle East and Caucasus, which includes Armenia, Azerbaijan, Georgia, Iraq, the Islamic Republic of Iran, Israel, Saudi Arabia, Turkey, and the United Arab Emirates (UAE).[1] Most of the countries included have substantial rail networks, and all except Israel, Saudi Arabia, and UAE are, or were, interconnected. All are now operated as government railways (map 6.1).

All railways except in the UAE provide passenger services. Most of the services carry a substantial volume, including a large commuter service in Israel and a substantial medium- and long-distance service in the Islamic Republic of Iran. The Islamic Republic of Iran also has a substantial freight business, based on minerals, while both Azerbaijan and Georgia have significant, although rather diminished, freight businesses, of which about one-third is oil traffic. Iraq

Map 6.1. Railways in the Middle East, Caucasus, and Turkey



Source: Map produced by the World Bank Geospatial Operations Support Team (GOST).

is recovering from war damage, and traffic volumes are very low, well below historic levels.

This report summarizes the key characteristics of the railways, as included in the Developing Country Railway Database (appendix A). The data have been collected from various public sources—annual railway or regulator reports and/or national statistical annuals. Most data are for 2018. All median figures shown in the graphs reflect the representative sample of railways included in this report and, importantly, the sample does not include some large railway networks, including those in North America, Europe, and China.

Institutional Structure

All railways in the Middle East, Caucasus, and Turkey are government owned, but in Armenia the railway was concessioned for 30 years to the South Caucasus Railway, a subsidiary of the Russian railways. All others are still government operated. The railways of both the Islamic Republic of Iran and Iraq are effectively operated as government departments; the remaining railways are state-owned enterprises. The railways of Georgia and the Islamic Republic of Iran are financially self-sustaining, in the sense they can normally finance their own asset renewals and replacements.[2] In Iraq, Azerbaijan, and Israel, all major infrastructure projects and renewals are financed by the government, either directly or indirectly. Passenger fares in many countries are kept low by government policy and contribute little, if anything, toward the cost of maintaining the infrastructure. However, the Islamic Republic of Iran has outsourced several long-distance services to third-party operators providing higher-standard services that allow higher fares to be charged. Currently, none of the railways, except in Turkey, has third-party access. In Turkey, two services are operated by independent operators, with their own locomotives, wagons and crew. For Saudi Arabia, the railway sector commenced its overall sector reform in 2017, with the intent of clarifying the roles, responsibilities, and structure of the two major railway companies in the country—the Saudi Railways Organization (SRO) and the Saudi Railway Company (SAR). SAR has been financed by the Public Investment Fund (PIF), a sovereign wealth fund. Currently, the networks operated by the SRO and SAR are not interconnected. The government of Saudi Arabia recently approved (February 2021) the merging of the two companies; Saudi Railways (SAR) will take over the country's original railway, Saudi Railways Organization (SRO).

The railway infrastructure in the UAE is the newest built in the region, as the planning of the network started in 2009. The Etihad Rail is the state-owned company in charge of: (1) the management of the development and construction of the railway network of the country, and (2) the operation of the transport services. For operation of transport services, in 2013 Etihad Rail created a joint venture with Deutsche Bahn. The joint venture started its commercial activity in January 2016, after Etihad Rail had completed the first phase of its network. The transport operations are presently limited to freight transport of granulated sulfur for the Abu Dhabi National Oil Company.

Only two countries in the region have seen private investment in infrastructure in the past 30 years: Armenia (brownfield) and Turkey (greenfield), amounting to a total of US$756 million.[3] In Armenia, in June 2008, a subsidiary of the Russian Railway Company was awarded a 30-year concession contract to operate the Armenian Railways. Turkey, in May 2019, awarded a contract to a private company to design, construct, and operate an inland intermodal

cargo terminal or railport in Kocaeli province.[4]

In 1998, the Organisation for Economic Co-operation and Development (OECD) developed a set of indicators of product market regulation (PMR) to measure a country's regulatory barriers to competition and to track reform progress over time. The PMR indicators measure the degree to which policies promote or inhibit competition in markets for products and services, collecting information on how entry and conduct in the relevant sector is regulated, and on the level of public ownership. They reflect the status of the existing laws and regulations, though do not capture the level of enforcement. The values range from 0 to 6, from the most to the least competition friendly regulatory regime. Table 6.1 below reflects the scores for Armenia, Azerbaijan, Georgia, Israel, and Turkey, based on inputs from a regional railway expert.

Table 6.1. Product Market Regulation Scores in the Caucasus, Israel, and Turkey, 2020

Country	PMR score	Economic regulator		Safety regulator	
Armenia	5.57	Yes	Ministry	Yes	Ministry
Azerbaijan	4.29	Yes	Ministry	Yes	Ministry
Georgia	5.57	Yes	Ministry	Yes	Ministry
Israel	0.50	Yes	Ministry	Yes	Ministry
Turkey	1.77	Yes	Ministry	Yes	Ministry

Source: Original calculations based on the OECD product market regulation (PMR) methodology. For more information, see: https://www.oecd.org/economy/reform/indicators-of-product-market-regulation/.

Current Situation

Networks

Railway development in the three Caucasus countries (Armenia, Azerbaijan, and Georgia) was initially intended to link Azerbaijan and Armenia to the Black Sea, with links later built north–south to Russia and the Islamic Republic of Iran. Subsequently, links were also built from Armenia to Turkey (now closed) and from Nakhichevan to the Islamic Republic of Iran. Georgia and Turkey have recently completed a direct connection through Kars. Azerbaijan has recently extended its Astara line over the border into the Islamic Republic of Iran as part of the planned north–south corridor from Russia to the Persian Gulf. The initial sections of the Turkish railway were built in the nineteenth century under the Ottoman Empire and gradually expanded to centers such as Damascus. Because Turkey has a long coastline encircling three-quarters of the country, much of the network links the interior of Turkey with the closest ports, and much interurban travel was by comparatively circuitous routes until recently.

Before World War I, the Iraqi railway was originally planned to be part of a through-route between Europe and Baghdad. However, it was not completed—including a line from Basra to Baghdad—until just before the World War II. The Iraqi railway is linked to Syria in the northwest (and thus to Turkey) and has a short branch to the Syrian border near Abu Kamal. The Iranian system

historically also had a connection to the Iraqi network. Currently, it connects to the Turkish and Armenian networks in the northwest, the Turkmen network in the northeast, and the Pakistani network in the southeast. The Iranian network is also currently completing connections to Azerbaijan and to Herat in Afghanistan. The Israel network had its origins in the Hejaz Railway, constructed from Syria to Medina, together with the railways built by the allied forces during World War I. At various times, connections with the Syrian, Lebanese, and Egyptian networks have provided additional links in the region, though none of these are operational today.

Currently, both Turkey and the Islamic Republic of Iran are significantly expanding their networks. Turkey has built high-speed rail lines between Ankara and Istanbul and between Ankara and Eskişehir, along with other planned lines joining major centers. The Islamic Republic of Iran is adding new lines to neighboring countries, new ports, and all provincial centers as yet unconnected. A plan to link Gulf states by rail under the aegis of the Gulf Cooperation Council (GCC) appears to have slowed as oil revenues of the members states have reduced.

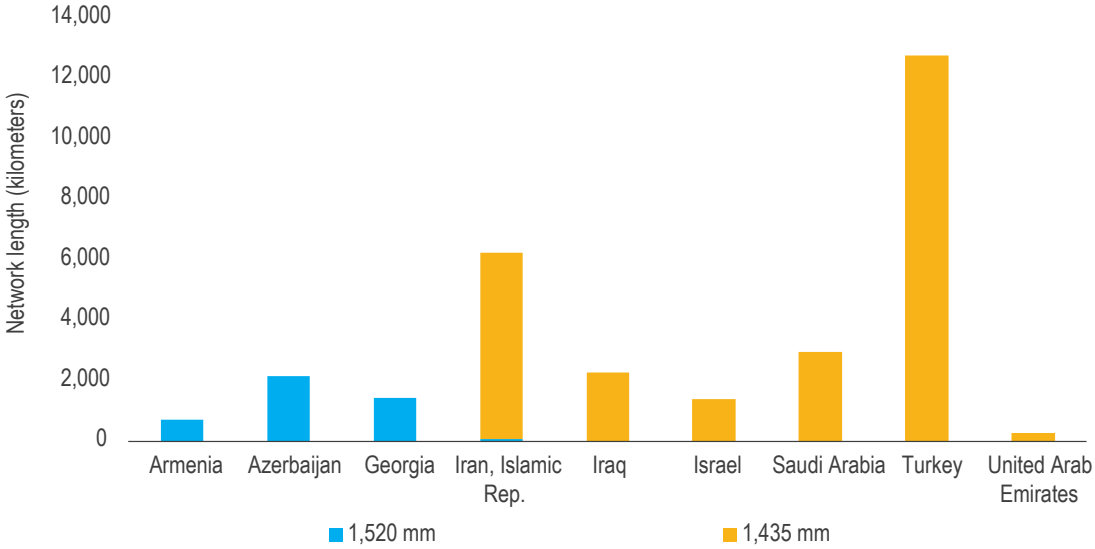
In Saudi Arabia, the SRO operates a network of railways with a total length of approximately 1,250 kilometers, including: (1) a freight line connecting King Abdul Aziz Port in Dammam with Riyadh; and (2) a passenger line connecting the city of Dammam with Riyadh. The SAR operates a freight network of 2,750 kilometers with two main lines: (1) the Riyadh-Qurayyat line, which begins at Riyadh and runs northwest toward Al Haditha near the Jordanian border; and (2) a line from the Al-Jalamid mine in the Northern Province, which runs southeast to the processing and export facilities in Ras Al Khair in the Eastern Province. The railway lines operated by SAR are built for an axle load of 32.5 tons allowing the operation of freight trains of 10,000 to 15,000 tons. Finally, the 450-kilometer Haramain High Speed Railway links Mecca and Medina, providing a safe and comfortable means of transport for Hajj pilgrims.

The government of the UAE started to build the railway network of the country in 2009. The network is planned to have a length of 1,200 kilometers, will connect all seven emirates of the country, and will link the other five countries of the Cooperation Council for the Arab States of the Gulf (GCC): Bahrain, Saudi Arabia, Qatar, Kuwait, and Oman. The network is planned to be double track, with an axle load of 32.5 tons, operating freight trains at maximum speed of 120 kilometers per hour (kph) and passenger trains at a speed of 200 kph. The signaling system is based on electronic interlocking and the European Train Control System (ETCS) Level 1. The construction of the railway network of the UAE is financed by the UAE Ministry of Finance and the Abu Dhabi Department of Finance. Presently, the first stage of construction of the railway network has been finalized, which spans 264 kilometers from Shah and Habshan (the location of gas fields in the emirate of Abu Dhabi) to the port in Ruwais on the western coast of the emirate of Abu Dhabi. Stage two of the project began construction in 2020, and stretches 605 kilometers from Ghuwaifat on the border with Saudi Arabia to the emirate of Fujairah on the east coast of the UAE. The rest of the railway network will be realized in a forthcoming third stage.

At the end of 2019, the operating public networks in the region totaled about 32,000 route-kilometers. The Turkish network is the largest (12,700 kilometers), with 6,000 kilometers in the Islamic Republic of Iran and the other five varying in the ranges of 250 to 3,600 kilometers (figure 6.1). The three Caucasus country networks are all Soviet gauge (1,520 millimeters), with the other four all standard gauge—apart from very short sections of broad gauge in the Islamic Republic of Iran connecting to the Commonwealth of Independent States (CIS) and Pakistan networks.

Much of the Iranian, Saudi, and Turkish networks have been expanded and upgraded significantly over the years, including electrification (in Turkey) and modern signaling. In Saudi Arabia, SAR was established in 2006 to construct the 2,400-kilometer north–south railway connecting the Gulf port of Jubail and Riyadh with the mining centers in the north. The line is currently in operation and is equipped

Figure 6.1. Railway Route-Kilometers in the Middle East, Caucasus and Turkey, 2018–2019



Source: See appendix B for country-level source information.

with electronic interlocking in all stations and ETCS Level 1 signaling. A new 115-kilometer line is under construction between Jubail and Dammam, together with the Saudi Landbridge, a new 950-kilometer line connecting Riyadh with Jeddah. The two projects have an estimated cost of US$7 billion. A link between the SRO and SAR terminals in Riyadh is also planned.

The Israeli network has been modernized extensively in the past decade (see box 6.1), including a new 160-kph line between Tel Aviv and Jerusalem. The Azerbaijan and Georgian networks have also been upgraded. Turkey has two high-speed lines and is planning or currently constructing several more. The Islamic Republic of Iran is also constructing a high-speed line from Tehran to Isfahan.

Other than in Iraq, which is still suffering from war damage, the mainline infrastructure in all regional systems is generally in reasonable condition, although some secondary lines are maintained to lower standards with resultant speed restrictions. Signaling ranges from very modern systems on the high-density lines to much simpler and older systems on lower-density lines.

Box 6.1. Modernization of the Israeli Network

In 2018, the first section of a new 56 kph, high-speed line between Jerusalem and Tel Aviv was opened, with the line reaching Tel Aviv itself in 2020. Services on the new line run every half hour and take 30 minutes, compared to 75 minutes on the old route. This has been complemented by a four-year, €6.5 billion (approximately US$7.34 billion) railway modernization strategy approved in 2016, including new stations and electrification (about 40 percent of the total expenditure), with the remainder intended for new signalling and communication systems, maintenance facilities, and new rail links. The combined effect of these projects when completed will be to almost double the number of trains running on the network each day, from 450 trains to nearly 900.

Source: World Bank analysis.

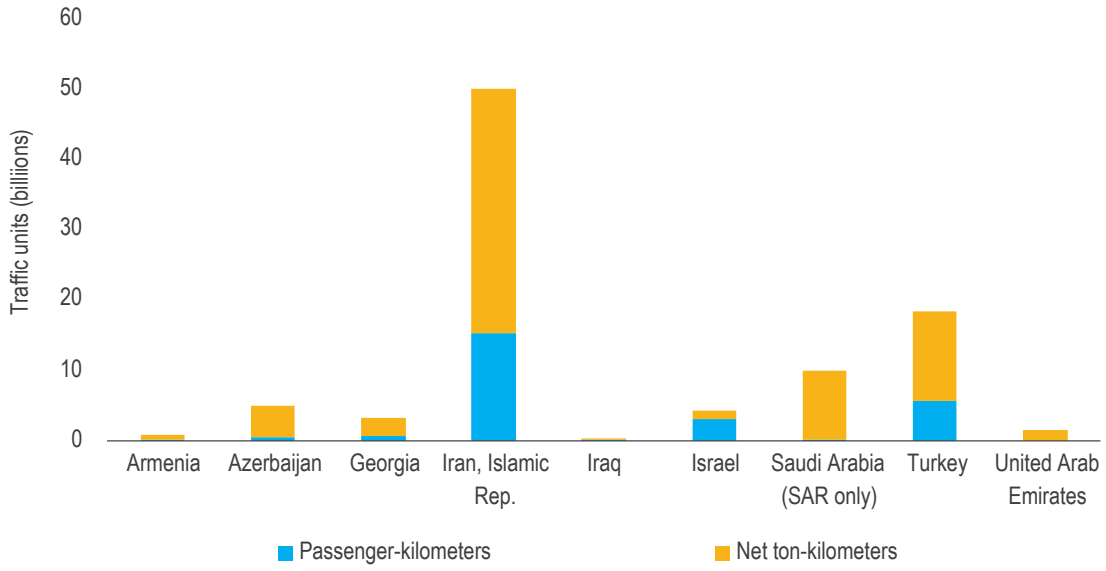
Traffic

In total, the railways annually carry 56 billion net ton-kilometers of freight and nearly 25 billion passenger-kilometers. The Islamic Republic of Iran's railway carries by far the most traffic (figure 6.2). Iran's rail freight includes minerals (about two-thirds of the total), followed by industrial products, such as cement and steel, along with oil products. Turkey's railway has the second largest volume of traffic, mostly minerals moving from the interior to ports. The railways in Georgia and Azerbaijan both carry transit oil traffic from the Caspian oilfields to terminals on the Black Sea. The other railways carry only limited volumes of freight. Road competition for general freight is very strong in all the countries. In Saudi Arabia, the passenger line connecting the city of Dammam with Riyadh carries approximately 1.3 million passengers per year; the freight line connecting King Abdul Aziz Port in Dammam with Riyadh carries approximately 800,000 twenty-foot equivalent units (TEUs) annually; and the north–south freight service contributes to the transportation of some 11 million tons of minerals (such as phosphate), hazardous substances (such as molten sulfur and phosphoric acid) from the north of the country, and bauxite from the central regions of the country to the Ras al-Khair Industrial Port in the Eastern Province.

In the UAE, the existing 264-kilometer network has the capacity to transport 22,000 tons of granulated sulfur each day from its sources at Habshan and Shah to its point of processing and export at Ruwais. More than 20 million tons have been carried in total by the Etihad Rail Deutsche Bahn (DB), since 2016, when the commercial transport services started.

All countries in this report provide relatively high-standard long-distance passenger services between the major population centers. Turkish Railway handles substantial commuter traffic in Istanbul and Israel has well-used commuter/interurban services. Air travel is a major competitor in both Turkey and the Islamic Republic of Iran for the longer-distance services, as is bus-based transport in all countries.

Figure 6.2. Railway Traffic in the Middle East, Caucasus and Turkey, 2018–2019



Source: See appendix B for country-level source information.

Pricing

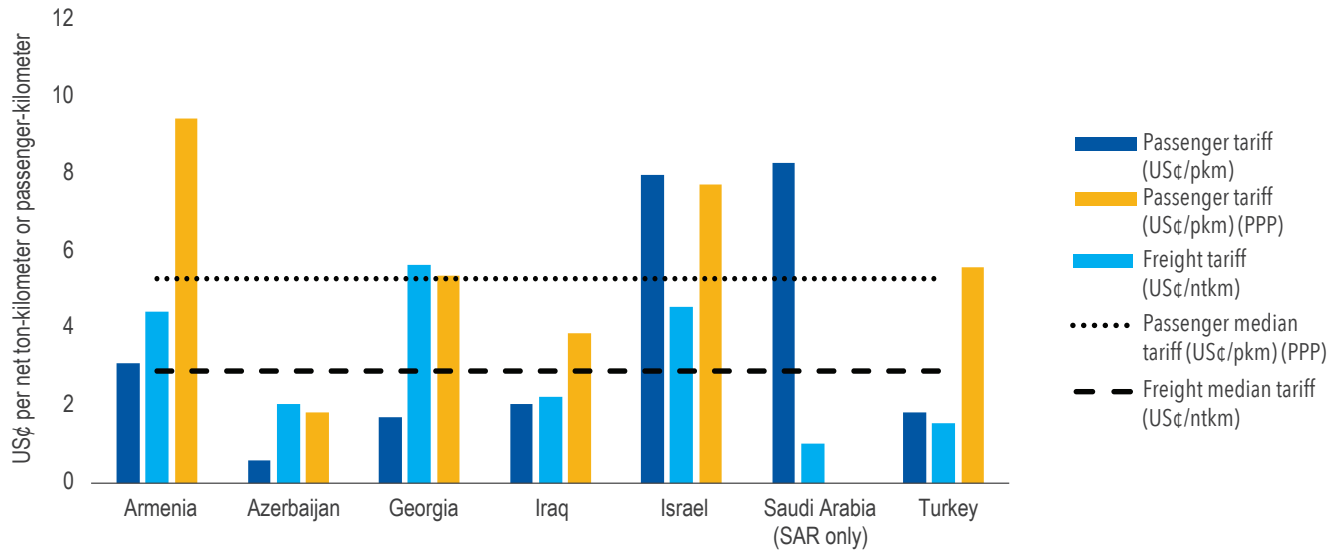
The passenger fares shown in figure 6.3 are systemwide averages over all classes of passengers; however, they are heavily weighted toward the standard (or economy) class. The price differential between standard class and upper class is significant. The average fare in Azerbaijan is very low by world standards; those in Israel and Armenia (where fares are heavily influenced by the comparatively expensive long-distance fares) have an average yield (revenue per passenger-kilometer) on a purchasing power parity (PPP) basis of about US$0.08 to US$0.09 per passenger-kilometer. Passenger tariffs for standard class in all countries except Georgia are controlled by the government, and for many railways the only way to increase the yield will be to alter the mix of services to reduce the lowest price offerings and encourage passengers to migrate to higher-fare services.

The Saudi Railways tariffs for passenger traffic are the highest in the region, in the range of about US$0.08. Lacking public service contracts, the rail services in Saudi Arabia are not self-financing.

Average freight tariffs on the major networks range from US$0.02 to US$0.04 per net ton-kilometer, similar to tariffs on other general-freight railways in comparable countries. The main exception is Georgia, where higher rates may reflect the difficult terrain. In Saudi Arabia, the SAR freight transport tariffs on the north–south line are very low, compared even with the most efficient railways in the world, in the limits of US$0.007 to US$0.011. For this reason, in spite of good productivity achieved by SAR in the utilization of its assets, the company accumulates financial losses. The freight tariffs on the north–south line are heavily subsidized by the government as a way to support the country's budding mining industry, which is considered one of the nation's tools to diversify its economy and reduce its heavy reliance on oil exports.

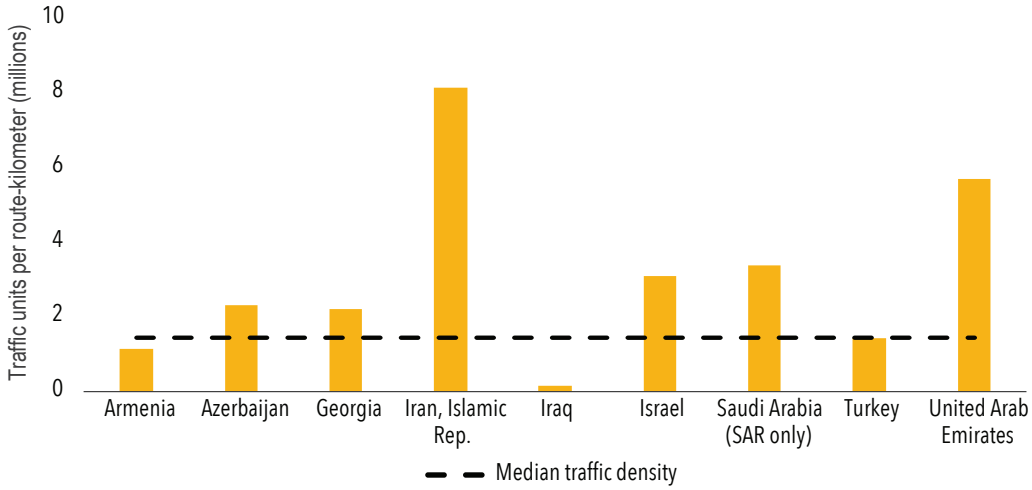
Overall, in the region tariffs are constrained by competition, principally from road and in some cases from alternative routes. Tariffs are also influenced by the traditional value-based tariff structures, the relative cost of carrying different commodities (as reflected in net tons per wagon roundtrip), direction of travel, and volume.

Figure 6.3. Average Railway Tariffs in the Middle East, Caucasus and Turkey, 2018



Source: See appendix B for country-level source information.
Note: ntkm = net ton-kilometer; pkm = passenger-km; PPP = purchasing power parity; US¢ = US cent (1/100 of US$1). Data not available for the Islamic Republic of Iran or the United Arab Emirates.

Figure 6.4. Railway Traffic Density in the Middle East, Caucasus, and Turkey, 2018–2019



Source: See appendix B for country-level source information.

Traffic density

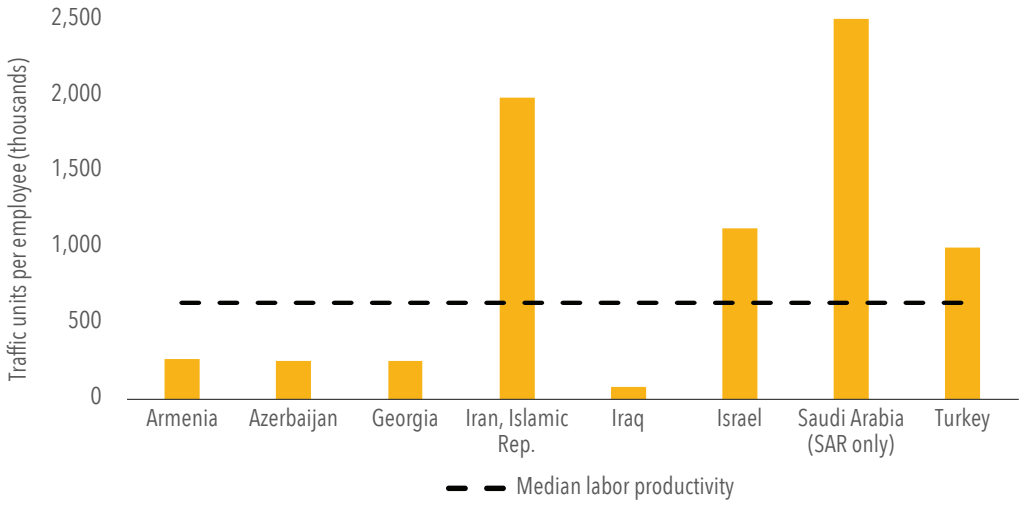
Traffic density is important because railway infrastructure has relatively high fixed costs and low variable costs. As a result, railway profitability is normally highly correlated with traffic density. Figure 6.4 shows the traffic densities. The Islamic Republic of Iran has the highest network density, at 6 million traffic units.[5] The railway infrastructure in the UAE achieved in 2019 a density of traffic of 5.7 million traffic units, facilitated by the operation of heavy block trains of about 15,000 tons each.

None of the other railways in the region has an average network density greater than 3 million traffic units. This is barely enough to fund infrastructure renewals and replacements unless relatively high freight rates are charged (as in Georgia). For Saudi Arabia, rail developments tend to be strategic in nature rather than solely financially driven.

Productivity

Labor and asset productivity (locomotive and wagon utilization) present a similar picture to network density. Figure 6.5 presents estimated labor productivity for the Middle East, Caucasus, and Turkey networks.

Figure 6.5. Railway Labor Productivity in the Middle East, Caucasus, and Turkey, 2018



Source: See appendix B for country-level source information.
Note: Data not available for the United Arab Emirates.

The Islamic Republic of Iran and Turkey have the highest labor productivity, at nearly 2 million traffic units per employee, helped by their substantial freight traffic. The Islamic Republic of Iran figure is an estimate after adjusting for the estimated staff in the subsidiary companies, which are the operators of the passenger and freight services. Israel also has high productivity, considering it is largely a passenger railway; however, Armenia, Azerbaijan and Georgia have quite low productivity. Iraq's productivity is very low because it is currently carrying very little traffic as it recovers from war damage. In Saudi Arabia, the SAR achieved a good staff productivity as a predominantly freight transport-oriented company, operating heavy block trains (10,000 to 15,000 tons) on long distances (more than 1,000 kilometers).

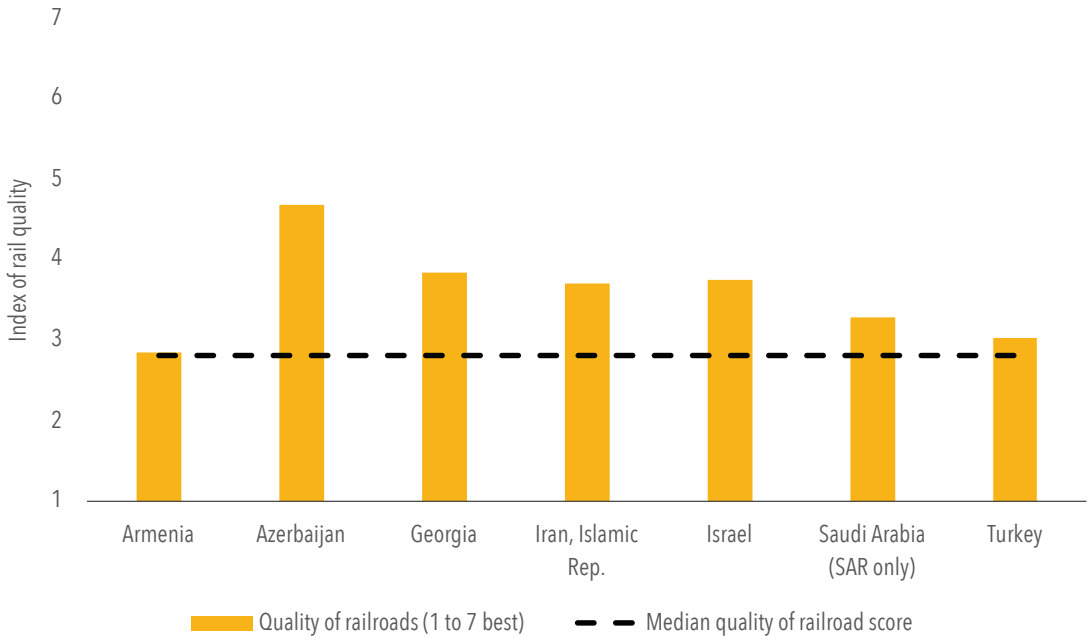
Quality of service

It is difficult to find an indicator of quality of service applicable across all railways. If the public is surveyed, their response will inevitably be in terms of passenger service, and this will also be the case with many businesses in the service sector. Manufacturers will consider the quality of the general freight service, either domestically or, more broadly, the handling of import/export shipments. Manufacturers will be primarily concerned with speed and reliability of service, damage, and cargo security. Shippers of bulk traffic will also weight cost as an important factor.

The indicator adopted for this study is the World Economic Forum (WEF) survey on the quality of railroad infrastructure for 2017 and 2018.[6] The quality of railway service covers a wide range of activities and, because the assessments are done by local businesses, they offer no guarantee of consistency in the scores, although the order of magnitude provides a general guide (figure 6.6).

To provide some context for these indexes, the Unites States scores 5.48, Germany 5.5, Japan 6.58, and Australia 4.07.

Figure 6.6. Indexes of Rail Quality in the Middle East, Caucasus, and Turkey, 2017–2018



Source: WEF 2017.
Note: Data not available for Iraq and the United Arab Emirates.

Notes

1. The Jordanian network is isolated from the private Aqaba line and a few tourist trains. The Syrian network has effectively ceased operations.
2. In Armenia, this is the responsibility of the concessionaire, which also receives a payment from the government for operating the passenger service.
3. Data from the World Bank Private Participation in Infrastructure (PPI) Database (https://ppi.worldbank.org/en/ppi).
4. The special purpose vehicle (SPV) is called Railport Terminal Isletmeleri A.S. and is owned by Arkas Holding S.A.'s affiliate Limar Liman ve Gemi Isletmeleri A.S. (66.6 percent) and Duisburger Hafen Aktiengesellschaft (Duisport) (33.3 percent).
5. Traffic units equal the sum of passenger-kilometers and net ton-kilometers.
6. The Quality of Railroad Infrastructure indicator is one of the components of the Global Competitiveness Index published annually by the World Economic Forum (WEF). It represents an assessment of the quality of the railroad system in a given country based on data from the WEF Executive Opinion Survey, a long-running and extensive survey tapping the opinions of more than 14,000 business leaders in 144 countries. The score for railroad infrastructure quality is based on only one question. The respondents are asked to rate the railroads in their country of operation on a scale from 1 (underdeveloped) to 7 (extensive and efficient by international standards). The individual responses are aggregated to produce a country score.

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Chapter 7:
Railways in North Africa

Introduction

This chapter presents a brief overview of the railways currently operating in North Africa (Morocco, Algeria and Tunisia in the Maghreb, and Egypt). State-owned enterprises manage rail infrastructure and provide both passenger and freight services (map 7.1).

Map 7.1. Railways in North Africa

Source: Map produced by the World Bank Geospatial Operations Support Team (GOST).

Institutional Structure

Railways established in the Maghreb during the colonial period were built and operated by the private sector under concessions generally featuring a government profit guarantee scheme. After countries recovered independence in the 1950s and 1960s, all rail activities were or had previously been taken over by state-owned "railway companies" placed under the control of the ministries of transport. Railway companies—the Moroccan National Railways Office (ONCF) in Morocco, National Rail Transportation Company (SNTF) in Algeria, and the Tunisian National Railway Company (SNCFT) in Tunisia—are the exclusive rail infrastructure managers and provide both passenger and freight services. In Morocco and Tunisia, existing legislation allows operation of specialized services by third-party operators; however, this opportunity has not yet been explored. ONCF and SNCFT are also responsible for network development, while in Algeria this activity is handled by a separate state-owned enterprise, the National Agency for the Planning and Implementation of Railway Investments (ANESRIF), under the control of the Ministry of Public Works. The relationship between the government of Morocco and ONCF is outlined by multiyear contrats-plans (plan contracts), ONCF and SNCFT are internally organized in various business units, including (1) infrastructure, (2) freight, (3) intercity passenger, (4) public service obligation (PSO) suburban passenger, if any, and (5) heavy maintenance rollingstock workshops. SNTF has kept a more traditional organization on a technical and regional basis, with separate marketing units for freight and passenger.

In the three Maghreb countries, the state entirely funds new infrastructure (network extension and major improvements of the existing network). Infrastructure maintenance is mostly funded by the railway companies, with some lump-sum state contributions in Algeria and Tunisia. Rollingstock acquisition and maintenance is funded by the railway companies, except acquisition of rollingstock used in services operated under a PSO scheme, which is in most cases funded by the state. The state provides financial compensation for PSO passenger services (suburban services) through elaborate contractual arrangements in Tunisia and on a lump-sum basis in Algeria; ONCF does not operate PSO services at present. Financial compensation for mandatory tariff rebates for specific customers is also provided by the state in Morocco and Tunisia. While ONCF is financially sound, SNCFT and, more particularly, SNTF are suffering from a very dismal financial situation despite the important public contributions they receive.

The Egyptian National Railway (ENR) is a state-owned entity charged with the management of the railway transport system in Egypt. ENR is organized as a vertically integrated entity and includes management of railway infrastructure, provision of the freight and passengers transport, and maintenance of rollingstock. The ENR is organized as an economic public authority and has a slightly different relationship with the state compared with the state-owned enterprises. The public financing of the economic public authorities in Egypt is limited to the surplus that goes to the state and contributions or loans offered to these entities in case of financial losses. The ENR is predominantly a passenger transport services entity and is not financially self-sustainable.

ENR prepares an annual preliminary budget and submits it to the Ministry of Transport (MoT). After MoT negotiates and approves the draft preliminary budget, it sends it to the Ministry of Finance, which—after further negotiations with the aim of increasing revenue and decreasing expenditures—sends it to parliament for adoption in the form of a law approving the tentative budget of ENR. Annual public

financing is disbursed by the Ministry of Finance directly to ENR as lump-sum, in installments based on the immediate needs of ENR and the cashflow of the Ministry of Finance. The government of Egypt also gives loans to the ENR. The financial contributions or the governmental loans are allocated for covering equally the operational expenditures and the investments.

Current Situation

Networks

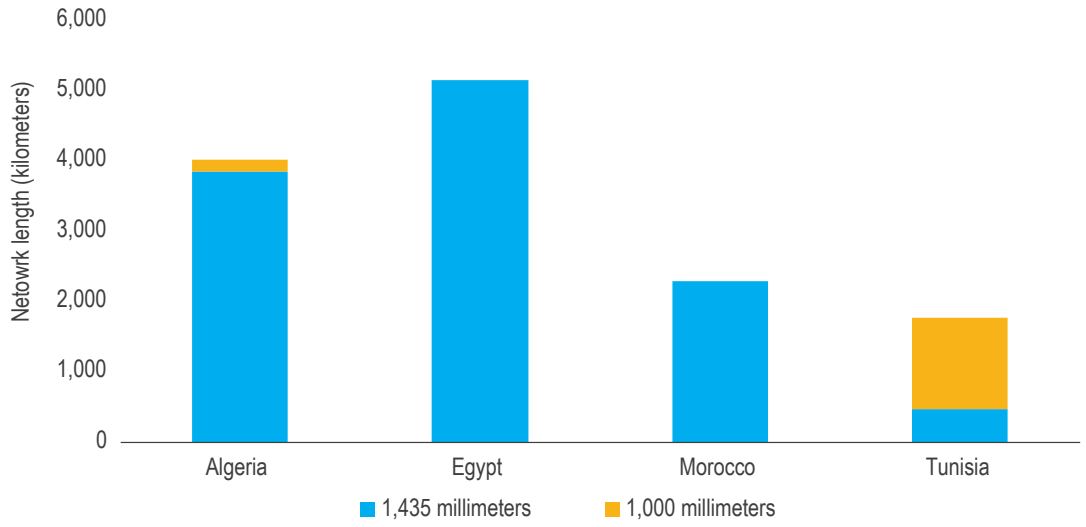
At the end of 2019, the operating network in North Africa totaled about 13,000 route-kilometers, out of which 8,000 kilometers were in the Maghreb countries, with more than 5,000 kilometers in Egypt (see figure 7.1).

In the Maghreb, Morocco's infrastructure is entirely standard gauge and Algeria has almost entirely completed a program of replacing meter-gauge with standard gauge lines. The Tunisian network is schematically standard gauge north of Tunis and meter-gauge south of Tunis; however, this configuration does not hinder railway services significantly. The three Maghreb networks are interconnected, but traffic between Morocco and Algeria has been interrupted since 1994 due to political discord between the two countries. In addition, exchanges between Algeria and Tunisia are limited to insignificant amounts of freight.

ONCF uses electric traction on 75 percent of its network, as does SNTF on Algiers suburban lines and on a line carrying iron ore and phosphate rock, along with SNCFT on its two suburban networks (Tunis and Sahel). Most of the lines in the three countries are equipped—or are presently being equipped—with modern signaling and telecommunication systems.

Morocco and Algeria are presently implementing important rail infrastructure investment programs. In 2018, Morocco commissioned a new 200-kilometer high-speed passenger line between Kenitra and Tangiers, which also improves capacity of the classical network, notably through track doubling on heavily trafficked itineraries. Algeria is modernizing the existing network through resorption of track renewal

Figure 7.1. Railway Route-Kilometers in North African Countries, 2018–2019



Source: See appendix B for country-level source information.

backlog, track realignment in difficult sections and line doubling and is executing a very ambitious program of new lines serving the less-developed part of the country. Tunisia is mainly focusing on expanding the Tunis and Sousse suburban networks and on rehabilitating some nonurban sections of the network.

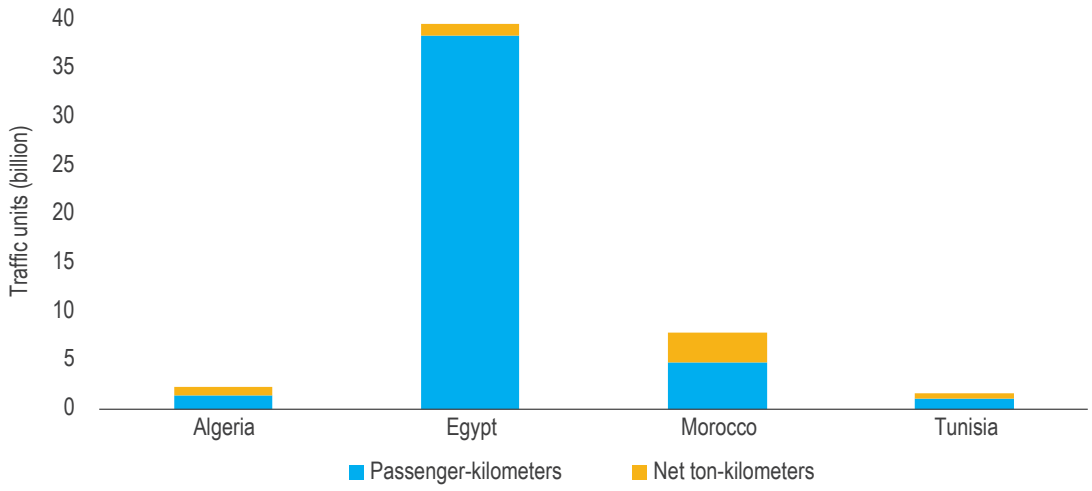
The existing railway network of Egypt connects the economy and population centres of the country. Main cities are linked by rail as well as ports, industrial, and mining centres. The government of Egypt has started an ambitious program for the modernization of the existing railway infrastructure, mainly along the Alexandria–Cairo–Aswan corridor, which is the backbone of the railway network. The modernization includes track renewal works and the installation of the signalling systems based on electronic interlocking and European Train Control System (ETCS)[1] Level 1. About 1,000 kilometers of track are currently under various stages of modernization, a vital project for enhancing the currently poor traffic safety in Egypt. No major development of the railway network seems necessary for the medium-term. A few short-distance new lines might be necessary to provide better connectivity with the railway network for the freight customers. A large project for establishing a first dedicated railway freight corridor between the port of Alexandria and the 6th of October dry port serving the Cairo area is envisaged to be built by the government, for private operation, by a different entity than the ENR.

Traffic

North African railways are predominantly passenger railways. In total, they carried nearly 45 billion passenger-kilometers against nearly 6 billion net ton-kilometers of freight (see figure 7.2).

ONCF offers intercity passenger services between main Moroccan cities. Services are mostly organized under the desserte cadencée (cyclic schedule) scheme, with generally suitable fares and a good quality of service in terms of frequency, commercial speed, punctuality and comfort. Consequently, competition from buses is quite limited on the routes served by rail. High-speed services introduced in 2018 on the Casablanca–Rabat–Tangiers route are a commercial success. In Algeria and Tunisia, shortage of modern rollingstock and track condition have in the last decades restricted volume and quality of service of intercity services. Buses and shared taxis (and air transport in Algeria) have seized an important share of the market traditionally served by rail. In Algeria, 2018 intercity passenger traffic

Figure 7.2. Railway Traffic in North African Countries, 2018–2019



Source: See appendix B for country-level source information.

volume is less than half of 1990 traffic. In Tunisia, intercity traffic was severely affected by disruption in SNCFT following the 2011 revolution; 2018 traffic volume amounts to only 50 percent of 2010 traffic.

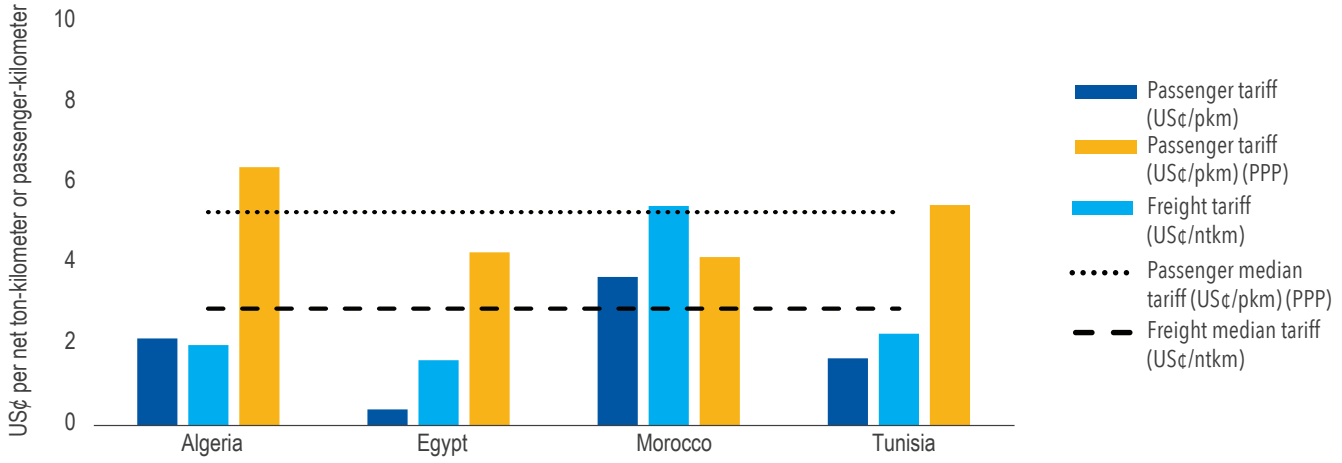
SNTF and SNCFT operate high-quality suburban services respectively in the Algiers region and in the Tunis and Sousse regions. In the two railway companies, suburban services presently account for about half of the total passenger activity and their development perspectives are excellent. In Tunisia, suburban traffic is the only rail activity that continued to increase after the difficulties encountered by SNCFT following the 2011 revolution.

In the Maghreb, transport of phosphate rock in the three countries, and iron ore in Algeria, used to be a key rail activity until the early 2000s. It continues to thrive in Morocco (even if development perspectives are limited). In Tunisia, political unrest in the phosphate mining area following the 2011 revolution led to a drastic decline in phosphate production and disturbance in rail transport, which was partly taken over by road transport. In Algeria, production of phosphate and iron ore also stagnated, and the deficient condition of the rail system serving the mines led to a decline in rail transport since the 1990s, with traffic also partly taken over by road transport. On the other segments of the freight market, including container traffic, railway companies are subject to fierce competition from the trucking industry and often have difficulties to provide adequate quality of service.

The total traffic in Egypt (passenger and freight) reached in 2019 about 40 billion traffic units; this traffic exceeds more than three times the combined traffic of the railways in Algeria, Morocco, and Tunisia. The Egyptian railway is predominantly a passenger railway, with passenger traffic accounting for about 97 percent of the physical activity of the railway, compared to 56 percent passenger traffic weight in Morocco and 56 percent in Algeria.

The passenger transport is organized along two types of services using dedicated train sets, for long and short distance. The long-distance passenger services connect all major cities of the country, while the short-distance services are provided mainly around the Cairo region. The passenger transport represents the priority of the ENR, while the freight transport is a marginal business that often suffers from limited availability of locomotives and of adequate structure of wagon fleet. Presently, the main commodities transported by rail include cereals, iron ore, coal, petroleum products, and construction materials. Egypt holds a high potential for developing the freight transport by rail. A better connectivity with the major ports of Egypt (Alexandria, Port Said, Damietta, among other ports) could significantly increase the market share of the rail transport, especially for container traffic.

Figure 7.3. Average Railway Tariffs in North African Countries, 2018–2019



Source: See appendix B for country-level source information.
Note: ntkm = net ton-kilometer; pkm = passenger-km; PPP = purchasing power parity; US¢ = US cent (1/100 of US$1).

Pricing

The passenger fares shown in figure 7.3 are systemwide averages over all classes of passengers, heavily weighted toward the standard (or economy) class in all countries. The price differential between standard class and upper class is significant. The average fare in Egypt is very low by world standards.

In Morocco, ONCF de facto enjoys wide flexibility to set Intercity passenger tariffs. In Algeria and Tunisia, all passenger tariffs applied by SNTF and SNCFT must be formally approved by the respective Ministry of Transport, similar to the process for all other public passenger transportation tariffs. In practice, during the recent past, the ministry has been reluctant to approve tariff increases, particularly in Tunisia. This situation has badly affected the financial situation of the railway enterprise. For PSO suburban services, the railway companies receive financial compensation from the government, on a lump-sum basis for SNTF and under elaborate contractual arrangements conducive to efficient operation of service and improvement of quality of service by SNCFT.

For freight tariffs, ONCF, SNTF, and SNCFT are entitled to freely negotiate tariffs with customers. However, government arbitration might be necessary when a state-owned enterprise is also a major customer (for example, the phosphate company in Tunisia).

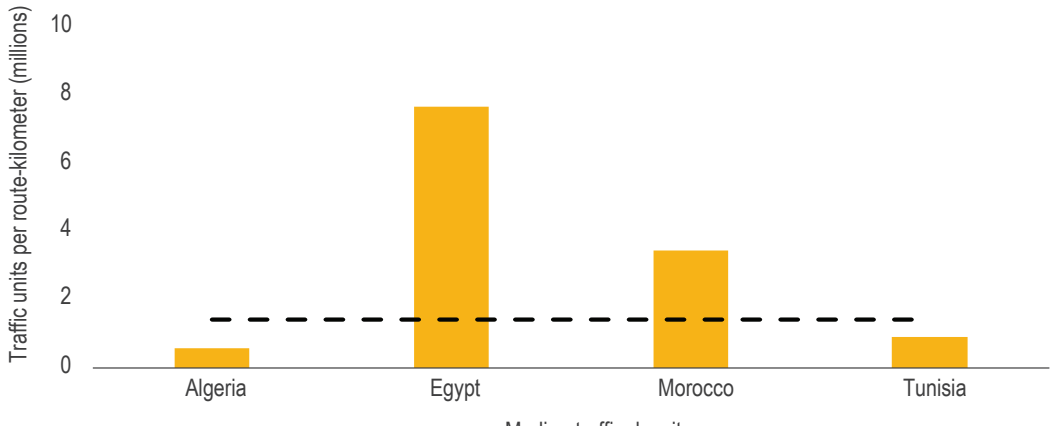
In Egypt, in 2019 the average revenue for passenger traffic amounted to LE0.065 Egyptian pounds (equivalent to 0.4 US cent) per passenger-kilometer. This very low level of revenue derives principally from low level of official tariffs approved by the government and from important discounts imposed on official tariffs by the government for various categories of travelers (for example, students, military, retirees). The government allocates annually lump-sum funds as subsidy for passenger transport. They are not structured as a real public services contract, (performance-based based compensation for the provided services) and do not cover the full deficit of the provided services.

The government of Egypt has recently increased freight tariffs, but the very low volume of traffic does not allow achieving financial sustainability. The average revenue for freight transport by rail in Egypt in 2019 was about LE0.27 (equivalent to 1.7 US cents) per ton-kilometer.

Traffic density

Traffic density is important because railway infrastructure has relatively high fixed costs and low variable costs. As a result, railway profitability is normally highly correlated with traffic density. Figure 7.4 shows the traffic densities for the North African railways. Egypt has the highest network density, at 7.7 million traffic units.[2]

Figure 7.4. Railway Traffic Density in North African Countries, 2018–2019



Source: See appendix B for country-level source information.

Network traffic density—along with labor productivity—are high in Morocco, thanks to heavy phosphate traffic and dense intercity passenger traffic; they are both major determining factors in the sound financial situation enjoyed by ONCF. In Tunisia, network density traffic fell from 1.8 million traffic units in 2010 to 0.9 million in 2018 (staff productivity fell from 770,000 units per employee to 360,000) because of a traffic plunge following the 2011 revolution. While SNCFT was not far from financial equilibrium in 2010, its financial situation has seriously worsened after 2011. In Algeria, traffic density, staff productivity, and rollingstock productivity are particularly low and serve as the main explanatory factors of SNTF's dismal financial situation. In fact, SNTF presently operates a railway whose size and configuration would allow it, with only limited additional assets, to handle three or four times the present volume of traffic. In 1990, SNTF was carrying nearly 6 billion traffic units (compared to 2.4 billion in 2018) on a smaller network than now. Increasing traffic is thus the major challenge facing SNTF for the years to come.

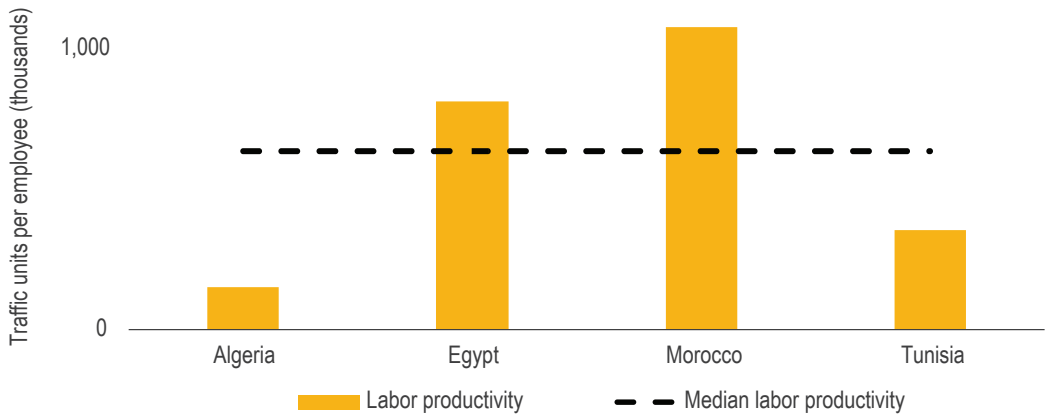
The high traffic density in Egypt comes from the dense operation of passenger traffic. ENR operates about 84 percent of the traffic realized by the Italian railways on a network a third the length of Italy's. However, the very low level of tariffs, the very low volume of more profitable freight transport, and the lack of clear relationships of the ENR with the government concerning the financial compensation for the passenger services as well as the financial contribution on the management of the infrastructure have nullifed the advantage of Egypt's excellent traffic density.

Productivity

Labor and asset productivity (locomotive and wagon utilization) present a similar picture to network density. Figure 7.5 presents estimated labor productivity for the North African railways.

The ENR steadily reduced its staff during the last two decades (from 84,977 in 1999 to 44,777 in 2019) for maintaining a good productivity of staff. In 2019, the ENR achieved a productivity of about 884,000 traffic-unit per staff—a strong number for a passenger-oriented railway with a high density of stations and a high number of trains operated daily. However, this indicator must be assessed in the general context of the railway transport condition in Egypt. Staff productivity may be considered as high compared with other passenger railways in the world (the average staff productivity in the European Union railways was about 696,000 traffic-units per staff in 2019).

Figure 7.5. Railway Labor Productivity in North African Countries, 2018–2019



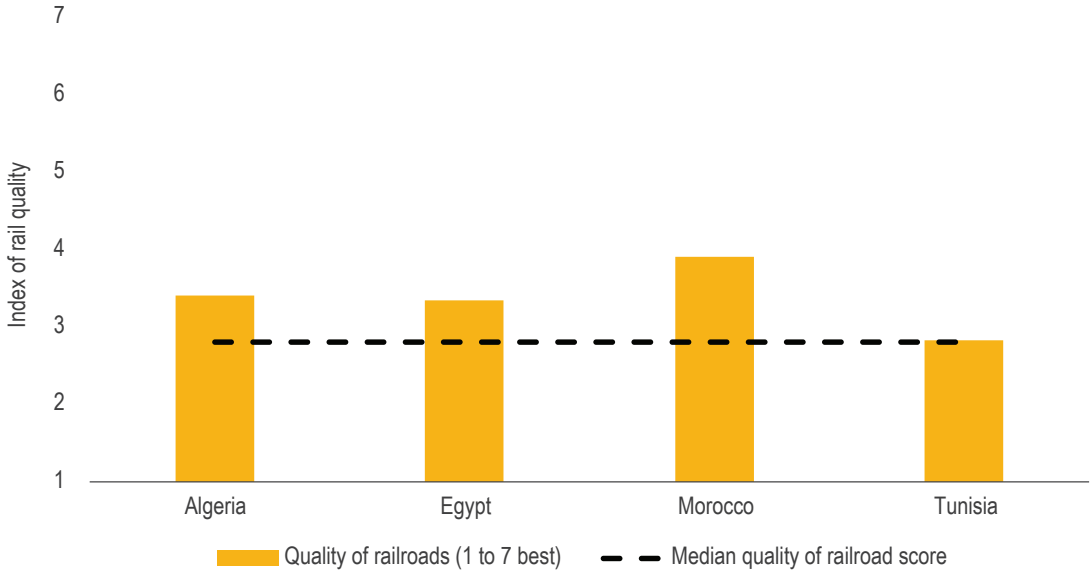
Source: See appendix B for country-level source information.

Quality of service

It is difficult to find an indicator of quality of service applicable across all railways. If the public is surveyed, their response will inevitably be in terms of passenger service, and this will also be the case with many businesses in the service sector. Manufacturers will consider the quality of the general freight service, either domestically or, more broadly, the handling of import/export shipments. Manufacturers will be primarily concerned with speed and reliability of service, damage, and cargo security. Shippers of bulk traffic will also weight cost as an important factor.

The indicator adopted for this study is the World Economic Forum (WEF) survey on the quality of railroad infrastructure for 2017 and 2018.[3] The quality of railway service covers a wide range of activities and, because the assessments are done by local businesses, they offer no guarantee of consistency in the scores, although the order of magnitude provides a general guide (see figure 7.6).

Figure 7.6. Indexes of Rail Quality in North African Countries, 2017–2018



Source: WEF 2017.

Notes

1. ETCS (European Train Control System) is the core signaling and train control component of ERTMS, (the European Rail Traffic Management System). ETCS uses balises installed along the track which communicate with onboard equipment on the locomotives, continuously calculating a safe maximum speed for each train. The on-board systems that take control and decrease the speed or stop the train if the permissible speed is exceeded by the driver.
2. Traffic units equal the sum of passenger-kilometers and net ton-kilometers.
3. The Quality of Railroad Infrastructure indicator is one of the components of the Global Competitiveness Index published annually by the World Economic Forum (WEF). It represents an assessment of the quality of the railroad system in a given country based on data from the WEF Executive Opinion Survey, a long-running and extensive survey tapping the opinions of more than 14,000 business leaders in 144 countries. The score for railroad infrastructure quality is based on only one question. The respondents are asked to rate the railroads in their country of operation on a scale from 1 (underdeveloped) to 7 (extensive and efficient by international standards). The individual responses are aggregated to produce a country score.

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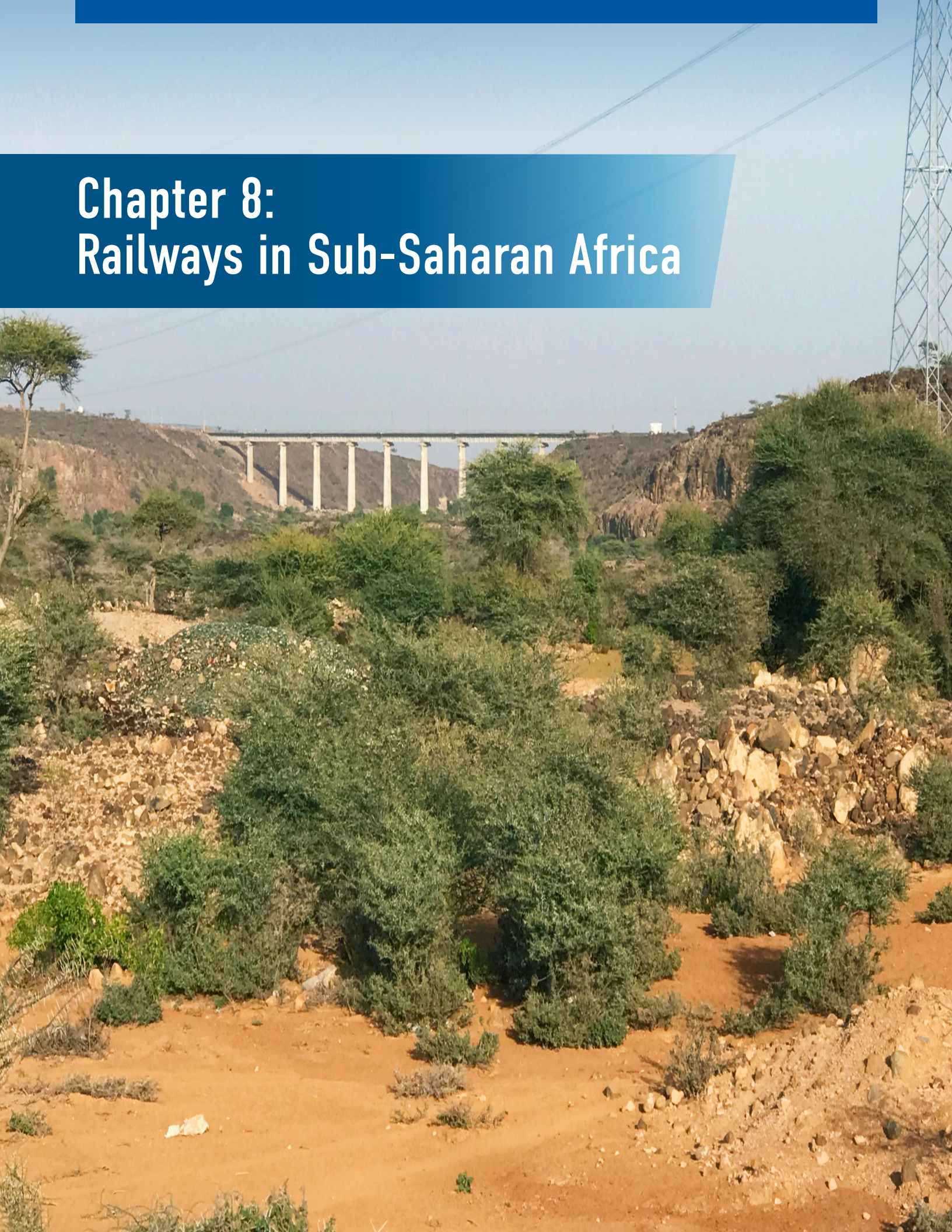
Chapter 8:
Railways in Sub-Saharan Africa



Introduction[1]

In the latter years of the 20th century, the role of rail in Sub-Saharan Africa (SSA) changed considerably. Fifty years ago, many of the railway systems were carrying a high share of their country's freight traffic. Often competing road transport had poor infrastructure or faced restrictive regulations. Rail customers were established businesses with physical connections to rail, and government policy encouraging parastatals to transport by rail. As transport was liberalized and roads were improved, rail faced much stronger competition. Railways lost traffic, and many entered a vicious cycle of decline.

Although some upgrading has occurred, most SSA networks carrying general freight and passengers are still operating to the standards to which they were originally constructed (see map 8.1). Many structures and even some trackwork are now more than 100 years old. Many railways have small-scale, undercapitalized networks operating with relatively low axle load, and at low speed. Combined with chronic under-maintenance over a long period of time, many sections of track have deteriorated, almost to the point of no return. This is a significant handicap for railways competing against modern roads, which are increasingly being constructed in major corridors.

To encourage the commercialization of the railways and reduce the burden on government finances, several countries concessioned their rail systems from the 1990s on. Some of these concessions were successful in terms of stabilizing, or even increasing, traffic volumes. Others were less so, with some concessions canceled and returned to government control, albeit often at a much higher level of efficiency. One of the hopes for concessioning was that concessionaires would themselves fund infrastructure improvements. Yet, few concessionaires had either the finances or the inclination to make such investments because traffic demand was generally insufficient to make the investments profitable.

However, rail infrastructure improvements encouraging modal shifts generate benefits in terms of lower road congestion and maintenance costs, accidents, pollution, and greenhouse gas emissions (GHG). These benefits, which accrue to the public as a whole, typically add 20 percent to 40 percent to the pure financial benefits captured by a concessionaire. Starting in 2005, these economic benefits were reflected in second-generation concessions that shifted responsibility for funding infrastructure investment to government.

In recent years, many governments across Africa have therefore taken a renewed interest in rehabilitating and upgrading their railways, or in constructing new ones. They desire to improve their logistics efficiency and promote a green mode of transport less carbon intensive than road. Major new lines have been constructed to higher standards (heavier axle loads and higher speeds), using third-party finance. However, good infrastructure, though an important prerequisite, is not by itself sufficient to create a successful railway. Well-maintained infrastructure needs to be combined with a commercial business model that provides competitive levels of service, develops new markets, and responds rapidly to changes in customers' requirements.

The railways in Africa can be divided into four broad groups:

- **Mineral railways:** These railways transport several million tons of traffic per year, typically from a mine to a port. They are usually financially self-sustaining, have high-quality infrastructure, and provide efficient service integrated into the main client's operations.

- **New railways:** These railways carry both passengers and general freight on newly built infrastructure. They provide relatively high-standard services, though many are not financially self-sustaining—raising questions about maintaining the high-standard service over the longer term.

- **Legacy railways:** These railways carry both passengers and general freight on historical infrastructure. These railways typically have deteriorated assets and are unable to provide high-quality services. They are often in challenging financial straits.

- **Commuter railways:** These railways carry passengers in urban areas and typically use existing infrastructure. The exception is the newly built Gautrain in South Africa.

Although the mineral railways are typically efficient and financially sustainable, many of the others face a range of challenges that can be broadly summarized as governance, funding, and traffic volume.

Map 8.1. Railways in Sub-Saharan Africa

Source: Map produced by the World Bank Cartography Unit.

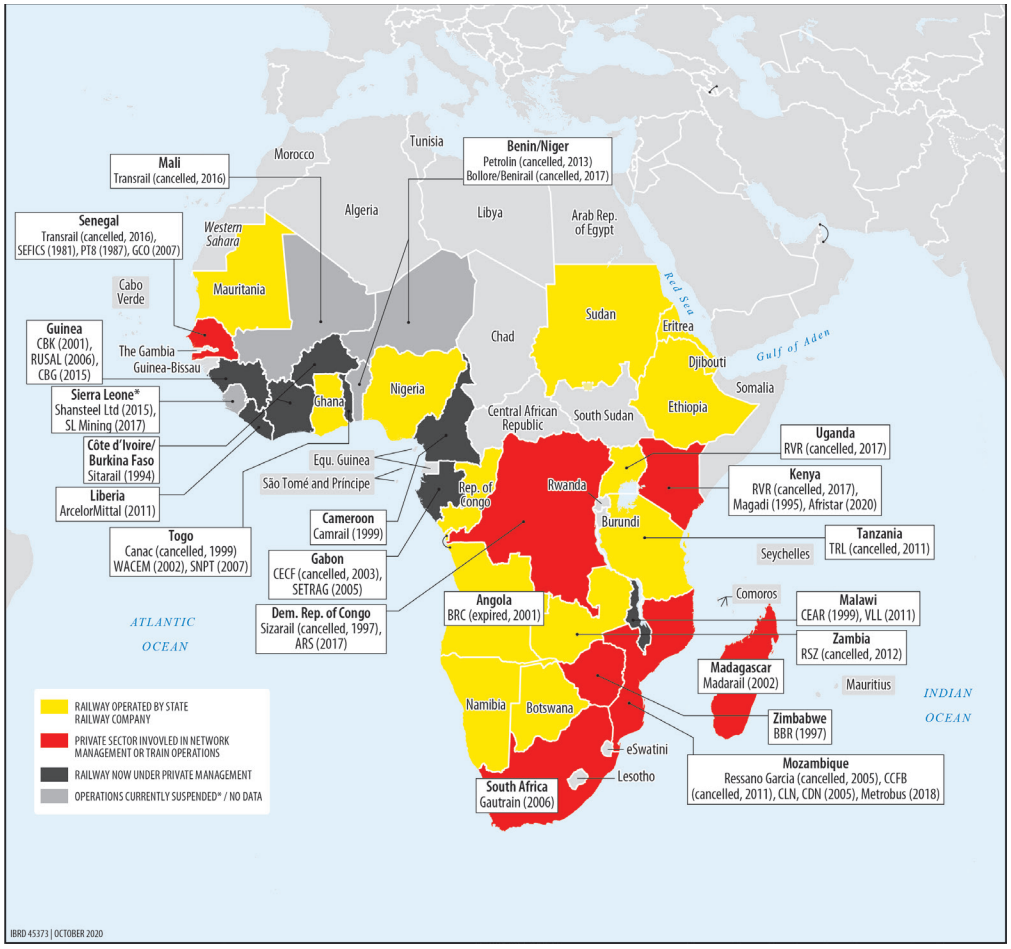
Institutional Arrangements

Until the 1980s, nearly all African railway companies were publicly owned corporations, working with varying degrees of financial and management autonomy. Attempts at commercialization while in public ownership were generally unsuccessful, and concessions began in the 1990s. Under these, the state remained the owner of some or all the existing assets, typically infrastructure, and transferred the other assets—generally the rollingstock, along with the responsibility for operating and maintaining the railway infrastructure—to a concessionaire.

Most countries in Central, East, and West Africa have at one time or another moved all or part of the way to concessioning (see figure 8.1).

Those railways that have not been concessioned or have since returned to government ownership remain subject to significant political and governmental influence. Specific arrangements vary across countries, but the sectoral ministry (normally transport) generally exercises political and administrative control, while the country's Ministry of Finance normally exercises financial control. Board

Figure 8.1. Public vs. Private Sector Participation in Railways Across Sub-Saharan Africa



Source: Map produced by the World Bank Cartography Unit.

directors are typically a combination of ministry officials and internal senior management, themselves often appointed by the government. Oversight is nominally assigned to parliament, but in practice such control may be limited to an audit of company accounts presented in its annual report, often disclosed several years in arrears. Although the governing regulatory frameworks nominally provide financial and management autonomy, in practice this is considerably limited by the many opportunities allowed for intervention by the state. This conflict between control and decision functions—and the frequent review by political authorities of initiatives and decisions under consideration by government's authorized representatives in the corporation—does much to discourage management initiatives and effectiveness.

Except for the railways immediately adjacent to South Africa, the networks with no or only partial concessions have continued to deteriorate over the past two decades. In some cases, these declines could prove terminal. Many railways have been left to deteriorate for too long and would require major investment to permanently reverse the situation.

Concessions

Of the 32 SSA countries with operating railways, 18 have opted for a concession arrangement at some time since 1992. However, seven countries have canceled their concessions, an additional four have been reassigned, and two have been badly affected by war and natural disasters.[2] The process of concessioning has often taken three to five years from concept to signed contract, sometimes much longer, and a wide range of arrangements on cost-sharing between the concessionaire and government have been implemented.

With little scope on most African networks for on-rail competition, few governments have seriously considered the European model of full vertical separation. However, some third-party operators carry their own traffic over government lines, such as in Kenya and Senegal, and a through-freight service operated for some years from South Africa to Tanzania.

The concessions also do not always include the entire network, with lightly used branch lines sometimes excluded. The initial duration of concessions varies from 15 to 30 years, and the concessionaire is free to operate its activity as a business, with freight tariffs generally market determined, and passenger fares subject to some form of indexation. Although formal regulatory structures with real teeth are rare in SSA, if a concessionaire fails to comply with the terms of the concession, whether by design or by force of circumstances, procedures could be followed to terminate the concession. These have been applied in several cases, with the railway either reverted to the government or transferred to another operator.

The rail concessions in SSA have attracted a limited pool of mainly foreign private operators. Private companies are the majority shareholders in all concessions to date. In Madagascar, the government holds 25 percent of Madarail, while governments own 10 percent to 20 percent in Sitarail (Côte d'Ivoire/ Burkina Faso) and Camrail (Cameroon). This gives government representation on the concession company's board and ensures the government has access to adequate information on the concession company's performance. Local private participation in concessions has generally been relatively low and often fraught with problems during the bidding process.

The concessions have not been without problems. In many cases, concessions faced difficulty in finding more than a few bidders, and in several cases, they had insufficient financial resources to finance the major investments required. Concessionaires were generally unenthusiastic about running passenger services, which often had regulated tariffs that did not recover service costs. Delays and disputes about the payment of government compensation for unprofitable services also presented a challenge. Further problems arose concerning the level of concession fees, the length of the concession, and the redundancy arrangements for staff no longer required after network concessioning. In some cases, this led to renegotiation of the concession contract.

Many concessions initially relied heavily upon the lending of international financial institutions (IFIs)

or bilateral loans to finance infrastructure. Though these offered below-market borrowing costs, lengthy loan tenors, and grace periods, they were often slow to mobilize. Much of this investment addressed backlogs in maintenance and renewal, without which railways could not function, and thus can be characterized as one-off investments to get struggling systems back on their feet.

Most of the early concession agreements clearly put the responsibility of financing track maintenance and renewal on private operators. When rosy traffic projections failed to materialize, concessionaires lacked funds for infrastructure renewal, creating a major disappointment for many governments.

Few, if any, of the concessions not related to minerals generate significant profits for their operators and certainly not enough to fund long-term renewals or improvements. Although most concessionaires pay concession fees into general government revenue, none could probably afford to do even this if they were properly accruing funds for future renewals. As a result, a different model has now emerged, in which governments assume greater responsibility for infrastructure funding.

Current Situation

Networks

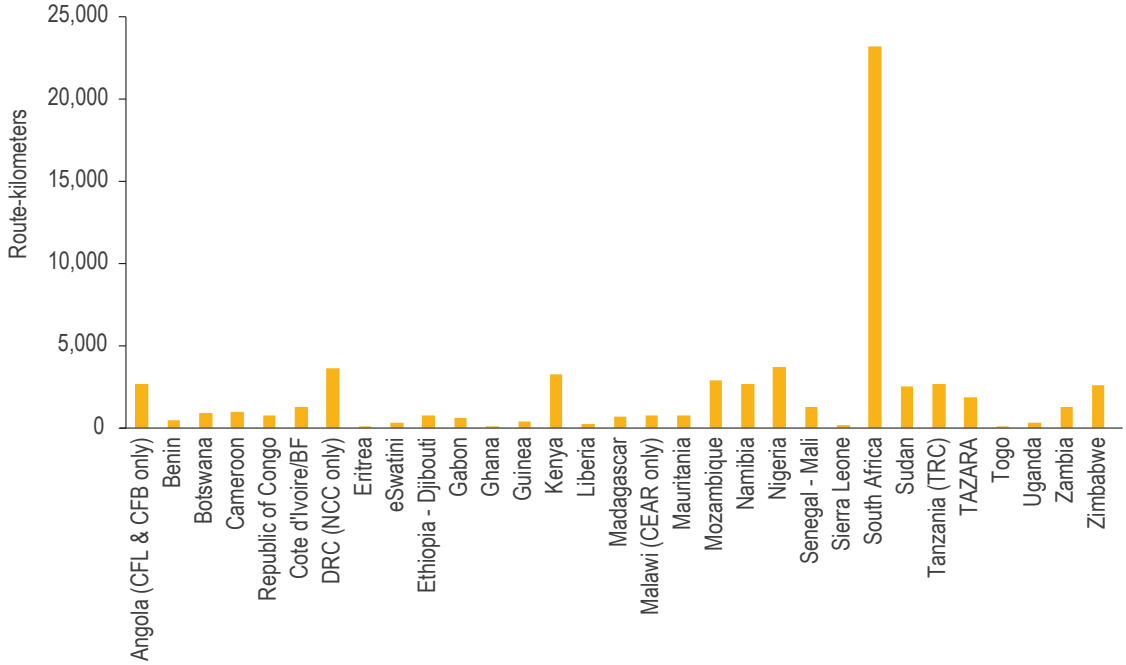
Railway development followed a similar pattern in almost all SSA countries. Isolated lines headed inland from a port to reach a trading center or a mine, and over time a few branch lines were built out from the main line. Many of the lines were state-owned, but some were constructed as concessions or by a mining company as an integral part of its operation. As a result, although grand master plans have existed for over a century, most African lines remain disconnected, linking a port and its immediate regional hinterland. The only significant international network is centered on South Africa, stretching north to Zimbabwe, Zambia, and the Democratic Republic of Congo, and west to Namibia and Botswana. However, trade between African countries (other than to and from South Africa) has always been small, due in large part to the similarity in the products exported, suggesting such interregional links would have been only lightly used even if they had existed.

At the end of 2019, railways were operating in 32 countries in SSA (as shown in map 8.1), totaling 65,760 route-kilometers, with individual railways ranging in length from under 100 route-kilometers in Togo and Ghana to more than 23,000 route-kilometers in South Africa (figure 8.2).[3]

As shown in figure 8.3, most railways in SSA use either Cape gauge (1,067 millimeters or 3 feet, 6 inches) or meter gauge. The main network in Southern and Central Africa is Cape gauge, which is also used in some Anglophone countries farther north. Meter gauge is used in most of Francophone Africa and much of East Africa. While several isolated railways use standard-gauge (1,435 millimeters) lines, primarily for mineral traffic, Nigeria is developing a standard-gauge network to serve its new capital of Abuja. Several lines with gauges as narrow as 600 millimeters have operated at various times, but most are now derelict. New stand-alone railways constructed in the last 20 years are largely standard gauge, including those in Ethiopia, Kenya, Tanzania, Guinea, and the Gautrain in South Africa.[4]

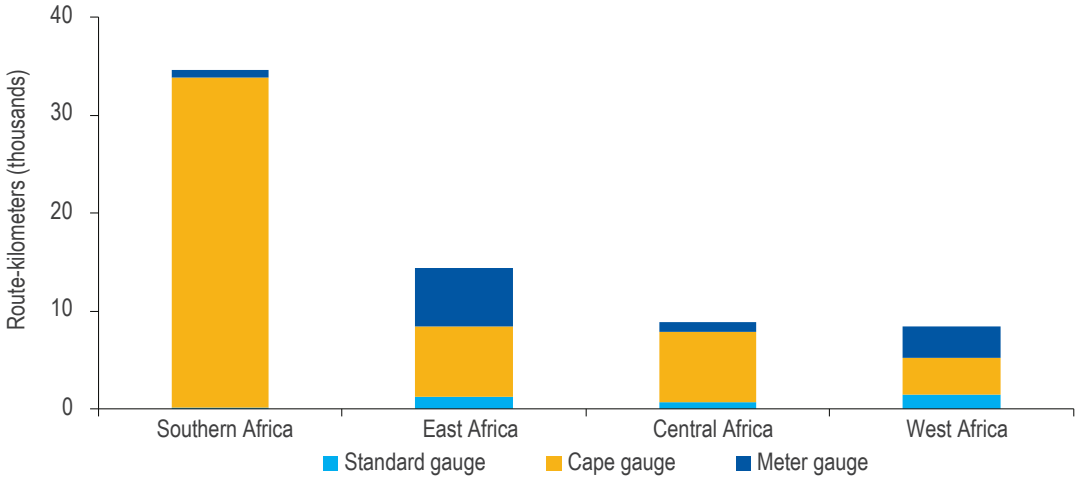
Almost all networks are single-track, except for sections of the South African network. Much of the South African network is electrified. The only other railways with electric power supply in SSA operate in the mining region of the Democratic Republic of Congo, a short section (currently abandoned) in Zimbabwe, and the new Djibouti–Addis Ababa

Figure 8.2. Railway Network, by Country, in Sub-Saharan Africa



Source: See appendix B for country-level source information..

Figure 8.3. Railway Network by Region and Gauge in Sub-Saharan Africa



Source: See appendix B for country-level source information.

railway. Most railways have considerable sections of track that require repair or replacement. Some countries have major sections not in use and will require rehabilitation before any operations can recommence. Even where services are operational, poor track conditions forces speed restrictions over long sections, resulting in a loss of railway competitiveness and rollingstock productivity.

Signaling on many networks still relies on manual systems. On most lines, the low train density means using mechanical signals or train orders is quite adequate from a capacity viewpoint, which often leads to significant safety problems as a result of human error. Even where power signaling has been installed, it is often not operational due to lack of electricity and dilapidated cable networks. Telephone

exchanges in many companies are similarly obsolete, with limited capacity and spare parts virtually impossible to find.

In summary, most general-purpose SSA railways face major infrastructure challenges, primarily associated with (1) aging track (insufficient ballast, rail wear—especially on curves—deteriorating earthworks, and formation); (2) civil works (most structures are in poor condition); and (3) signaling and telecommunications (obsolete equipment and lack of spare parts). The cost of rehabilitating such lines is large compared to the existing traffic volumes and revenues. How to rehabilitate the lines on a sustainable basis is the key issue faced by most SSA railways.

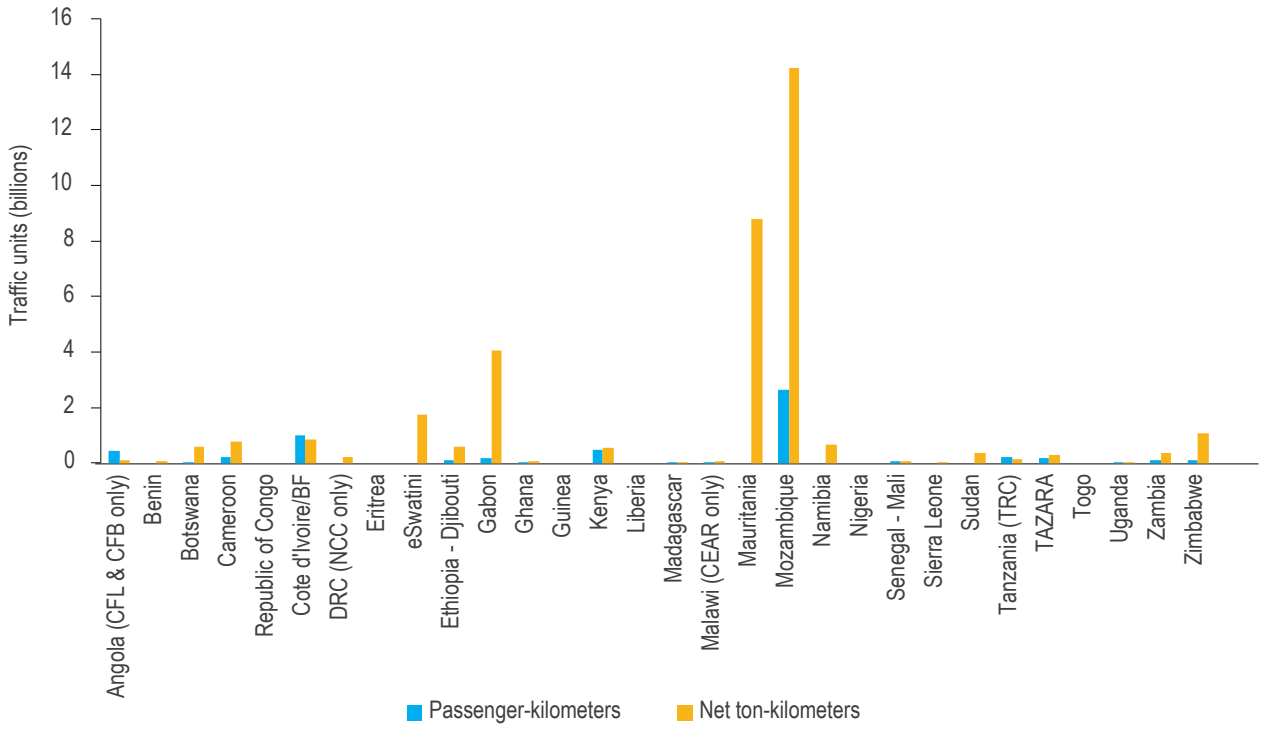
Traffic

In total, the SSA railways carried 300 million tons (181 billion net ton-kilometers) of freight and 305 million passengers (12 billion passenger-kilometers) in their last reported year. These railways range in traffic from the small West African railways carrying a few hundred thousand tons and almost no passengers, to South Africa, with 215 million tons and 285 million passengers in 2018 (figure 8.4).

Specialized mineral lines in West and Southern Africa carry more than half the freight (as measured by net ton-kilometers). South Africa has by far the most heavily used network, with its specialist Transnet coal and ore export lines. Southern Africa as a whole also dominates general rail freight, handling more than 80 percent of the freight traffic on the nonmineral lines. It also dominates the passenger business, with more than 70 percent of passenger-kilometers, largely because of its heavy commuter passenger business. An increasing number of SSA cities also operate (or have operated) commuter services; however, except for in Dakar, these are generally one or two peak-hour services a short way out along the main line.

Most SSA railways are small by world standards, with the busier railways carrying only 1 billion traffic units per year. In contrast, Transnet in South Africa carries

Figure 8.4. Railway Traffic in Sub-Saharan Africa



Source: See appendix B for country-level source information.
Note: South Africa is not shown in the graph because its scale would dwarf all the other railways. South Africa had 6,788 million passenger-kilometers and 152,410 ton-kilometers.

this volume of traffic every three days. In overall terms, most SSA railways carry volumes similar to a moderately busy branch line on other railways. In some cases, this is due to lack of demand, but in others it is caused by shortages of rollingstock, particularly locomotives.

Most railways in SSA carry far more freight than passengers—freight averages more than 90 percent of total traffic units. Almost all railways in SSA carry some passenger traffic; only Eswatini and, from 1998 until recently, Uganda operate freight-only railways. However, the nonurban passenger business is steadily diminishing in importance, and several of the railways that retain a reasonable passenger business only do so because competing road networks either do not exist or are in very poor condition. The only significant cross-border passenger flows are on the Sitarail, Transrail, and TAZARA networks.

While the average freight haul on SSA networks is relatively long compared to network size, it is not especially so in terms of competing with road. Some railways carry predominantly end-to-end traffic; Tanzania Railways Corporation (TRC), TAZARA, and Transrail (when it was operating) all haul freight an average distance of 1,000 kilometers. Some smaller railways, such as the network in Uganda or Central East African Railways (CEAR), act as feeders to other systems that subsequently on-carry the traffic a further few hundred kilometers. These systems have a good chance of competing for general freight traffic, even as the road network is improved, as long as satisfactory service levels can be achieved. However, the shorter systems that require transshipment to road at railheads will generally find they need to be innovative, efficient, and customer friendly to compete effectively, even for bulk traffics.

Freight traffic on SSA railways is dominated by bulk and semibulk commodities, principally to and from ports. The actual traffics carried reflect the economic structure of the regions served by the railway. Mining products are important in several countries (for example, Gabon, Guinea, Liberia, Mauritania, Mozambique, Sierra Leone, and South Africa). Timber is important throughout West Africa, together with export crops. Imported flows are mostly manufactured products, such as cement, petroleum products, and general freight. On some systems, much of the general freight is containerized (higher-value cash crops are increasingly traveling in this way), particularly when the trip involves crossing a country border before the port. Unlike for passenger services, having significant imbalances between traffic in the two directions is common. Even where tonnage is approximately balanced, the differences in the commodity mix, with many requiring specialized wagons, means trains are rarely fully loaded in both directions. In some cases, this natural imbalance in traffic is accentuated for rail as road vehicles delivering imports tend to backload freight at marginal cost, leaving rail to transport the remaining freight without a compensating return load.

Since 2005, most SSA countries have experienced steady economic growth, with corresponding increases in trade and per capita gross domestic product (GDP). However, despite the generally favorable economic background, only a few railways have experienced a growth in traffic. These include several railways with large volumes of mineral traffic—South Africa, Eswatini, Mozambique, and Gabon—and only mixed-traffic railways, Sitarail and Ethiopia–Djibouti Railway. When available, 2019 data for Kenya and Ethiopia are also expected to show increases. Long-distance passenger traffic has mostly stagnated or declined, apart from the services on the new Kenyan and Ethiopian lines. Previously almost unknown outside South Africa and Senegal, suburban passenger traffic has emerged across SSA.

This growth or decline of traffic has often had little to do with changes in the underlying demand. War or natural disaster has often had a major impact. On some railways, the volume carried is constrained by insufficient rollingstock, particularly locomotives. Many smaller SSA railways have a low locomotive availability. When this is addressed, either through new or secondhand locomotives being obtained, or through locomotive rehabilitation, traffic often increases accordingly. The increase in road competition is also a key factor.

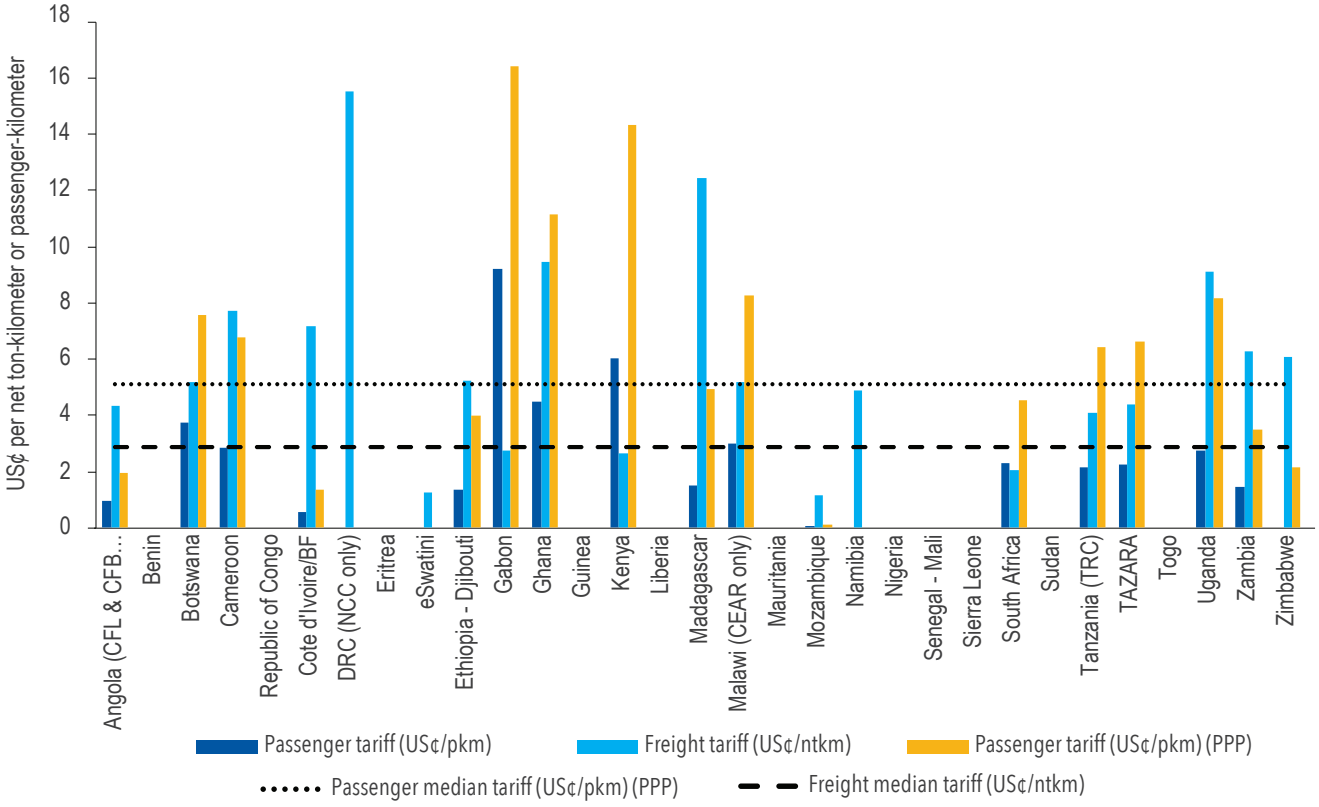
Pricing

Almost all passenger services face strong competition from buses and shared taxis in both price and service frequency. Few corridors remain in which rail passenger services are the only effective means of transport. Bus fares are typically about 30 percent to 50 percent higher than the economy rail fares, which typically range from US$0.01 to US$0.03 per passenger-kilometer, as shown in figure 8.5. However, on most routes, buses are faster (sometimes twice as fast), with generally a much higher service frequency. Many competing bus services suffer from the same problems as rail: often unreliable departures, delays, breakdowns en route, and overcrowding. Although rail is generally perceived as safer and, on some routes, allows the carriage of large quantities of produce and baggage, bus typically claims the lion's share of the market.

Average freight tariffs typically[5] range from US$0.03 to US$0.06 per net ton-kilometer, similar to tariffs on other general-freight railways in comparable countries. Tariffs are generally constrained by competition, either from road or from alternative rail routes (particularly in West Africa, the Great Lakes region, Malawi, and Zambia) and are also influenced by the traditional value-based tariff structures, length of haul, the relative cost of carrying different commodities (as reflected in net tons per wagon roundtrip), direction of travel, and volume. However, in spite of most rail rates being well below comparable road rates, especially for traffics such as containers, rail typically only carries 20 percent to 50 percent of the traffic in a corridor, and some of the smaller state-owned railways have a much smaller share.

Line-haul tariffs are only part of the price equation for freight traffic. Much is often made of the inherent lower cost of rail as compared to road. This is certainly true where minerals must be transported from a rail-connected mine to a rail-connected port. But the advantage is less clear-cut

Figure 8.5. Railway Average Tariffs in Sub-Saharan Africa



Source: See appendix B for country-level source information.
Note: ntkm = net ton-kilometer; pkm = passenger-km; PPP = purchasing power parity; US¢ = US cent (1/100 of US$1).

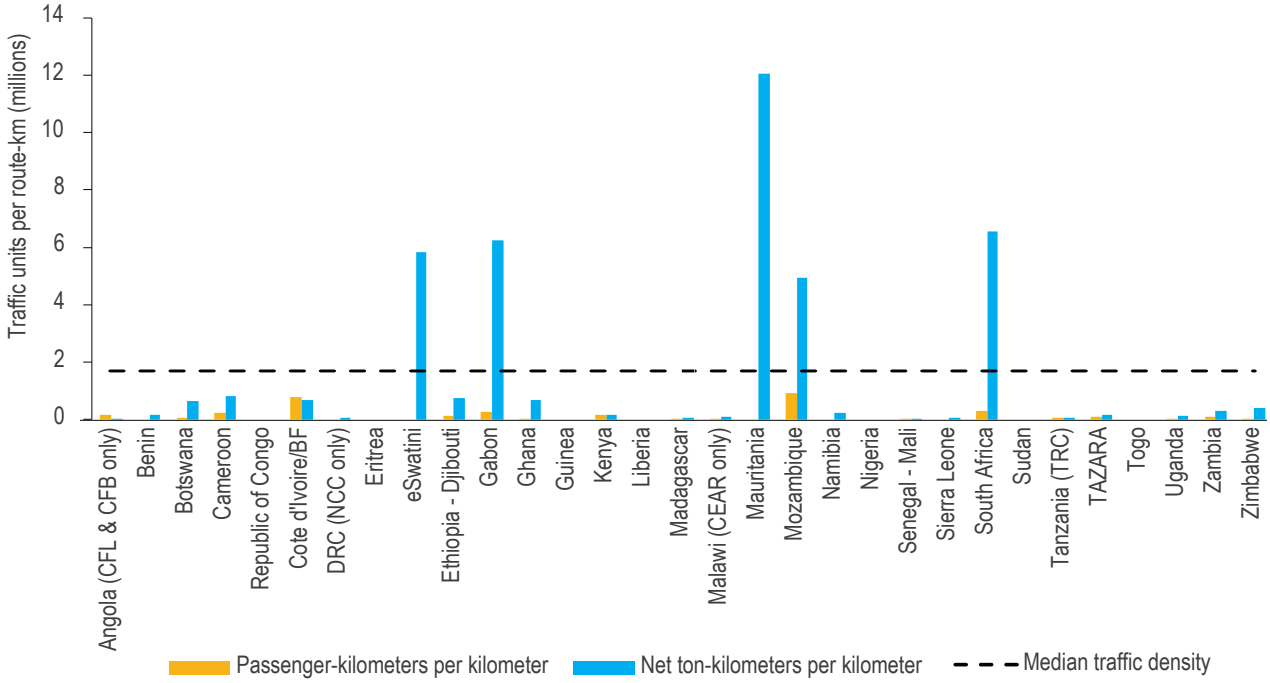
for medium-distance general freight, which is also often transported by road to and from the railheads. Haulage between the railway and the ultimate origin and destination can often cost up to the equivalent of 200 to 300 kilometers of line-haul transport, negating any advantage rail may have in pure line-haul tariffs. New sidings are sometimes constructed, but these need a minimum traffic volume to be economical for a railway. Traffic that needs to be transshipped at a central depot before dispatching by rail is thus more vulnerable to road competition, and even bulk traffics are not immune if distances are not too great. In many countries collection and distribution chains for many commodities are being streamlined, often involving the elimination of upcountry depots and distribution centers, and marketing channels have become more diversified. Railways have often been slow to respond, steadily losing market share, and this again emphasizes the need for SSA railways to actively develop efficient multimodal services specifically designed for customer needs.

Network density

Network density is important because railways, especially railway infrastructure, have relatively high fixed costs and low variable costs. For railway infrastructure, the proportion of fixed costs will "differ by lines and traffic levels but rarely is estimated at less than 70 percent" (World Bank 2017) and is often closer to 100 percent for low-density lines. As a result, railway profitability is normally highly correlated with traffic density. Railways with high dedicated minerals flows thus tend to be more profitable and financially sustainable.

Traffic volumes on general-purpose SSA railways are low, and network densities (expressed as traffic units[6] per route-kilometer) are correspondingly low. The highest average network traffic densities outside South Africa and Eswatini are in Mauritania (12 million traffic units), Gabon (6.5 million traffic units), and Mozambique (5.2 million, largely driven by the Nacala traffic). Cameroon (1.3 million) is the only other railway to be over 1 million, although both Kenya and Ethiopia should have easily reached this density by 2019.[7] Many other railways average under 500,000 (figure 8.6). By comparison, in Europe most systems average 2 million to 5 million, with densities below 1 million found only in Albania and Montenegro. SSA railways are therefore mostly lightly used by world standards.

Figure 8.6. Railway Traffic Density in Sub-Saharan Africa



Source: See appendix B for country-level source information.

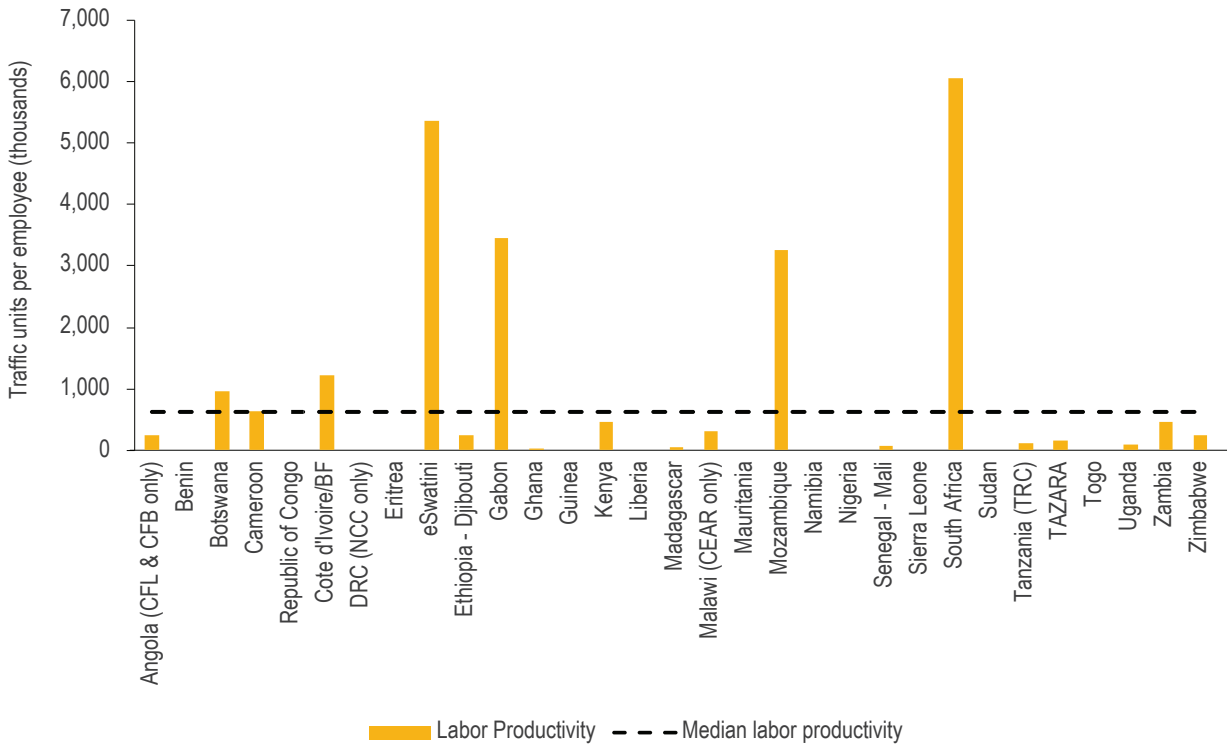
Many networks struggle to generate enough funds from their own resources to maintain and renew their infrastructure as required. It is possible to operate railways without external financial support at these densities, but not forever—and generally only with a low level of service. For low-value traffic items, this is not necessarily a problem, but for passenger services and for higher-value freight subject to road competition, it presents a very difficult task. If a government wants a reasonable level of service at such densities, it would need to provide ongoing financial support.

Productivity

Both labor and asset productivity (locomotive and wagon utilization) are low in many SSA networks compared to railways elsewhere, due to the poor condition of the infrastructure and rollingstock and low traffic levels. One of the most visible characteristics of the concessions has been the sharp improvement in these indicators, partly because of growth in traffic, but mostly due to major reductions in the workforces and the disposal of life-expired rollingstock.

Almost all railway companies have streamlined their work forces over the past 20 to 25 years. This was often the prelude to concessioning; however, in some cases has also been part of a general policy to improve efficiency. Despite this, labor productivity on most SSA systems is relatively low by world standards, with few railways achieving over 500,000 traffic units per staff per annum (see figure 8.7). Rollingstock productivity is similarly low, with the root cause generally being low availability caused by lack of spare parts. The low labor productivity often reflects the continuing use of labor-intensive methods with relatively little outsourcing. But for many systems with very low productivity, it is the consequence of traffic steadily declining without

Figure 8.7. Railway Labor Productivity in Sub-Saharan Africa



Source: See appendix B for country-level source information.

any adjustment to staff levels. With low wages, the direct financial impact is not always fatal. But a large body of staff who are semi-employed has a corrosive effect on morale and is a strong disincentive for those who wish to improve efficiency. It is also a powerful factor in limiting the general pay level of rail workers. Unless salary levels are competitive, railways find it hard to recruit and retain technically competent employees or to introduce the technology required to improve service levels, for which a better-paid and more skilled workforce is essential.

Labor and asset productivity improved steadily in most concessions, typically doubling as a result of the large workforce reductions either prior or at the time of concessioning, the scrapping of obsolete rollingstock, and, in most cases, the increased traffic volumes. Where concessions have been canceled, and the railways reverted to public ownership, these productivity improvements have largely been maintained.

Safety is also an important aspect of operational performance. Rail travel is still safer than road travel, but its record in SSA is much worse than comparable railways elsewhere. This is caused by a combination of obsolete track infrastructure, poorly maintained rollingstock, and lack of operational discipline. However, as with productivity, safety has generally improved following concessioning.

Profitability

Most state-owned railways in SSA just about break even on a cash basis, after receipt of government support. But often this is only because a significant amount of maintenance has been deferred. When the maintenance backlog becomes too great, it is typically addressed using a loan with the expenditure treated as investment. The two companies that have been concessioned the longest, Sitarail and Camrail, make modest cash surpluses, but in recent years the substantial depreciation allowances have generated overall losses. By contrast, SETRAG, another rail concession in Gabon, is backed by mineral traffic and makes a healthy profit that finances two-thirds of an annual investment program of more than €40 million (approximately US$45.4 million).

Passenger services generally do not contribute significantly to the cost of maintaining infrastructure or to covering corporate overheads. Many passenger services struggle to cover their marginal costs (train crew, rollingstock maintenance, fuel and/or traction electricity, and passenger handling costs). Passenger tariffs on many railways are essentially administered, often within a framework that only includes a subset of total costs. Many of the more poorly performing systems in SSA would be unable to cover above-rail working expenses on a systemwide level even if they had the freedom to set their own tariffs.

Freight services normally cover their avoidable operating costs. Some earn enough to also cover rollingstock capital costs and even infrastructure costs. This is a function of, on the revenue side, the tariff rate and the average wagon loading and, on the cost side, factors such as train size, commercial speed, and rollingstock utilization and availability. General freight can typically earn enough to make operating services worthwhile, but only in some cases can it fund replacement rollingstock and very rarely can it earn enough to finance infrastructure renewal.

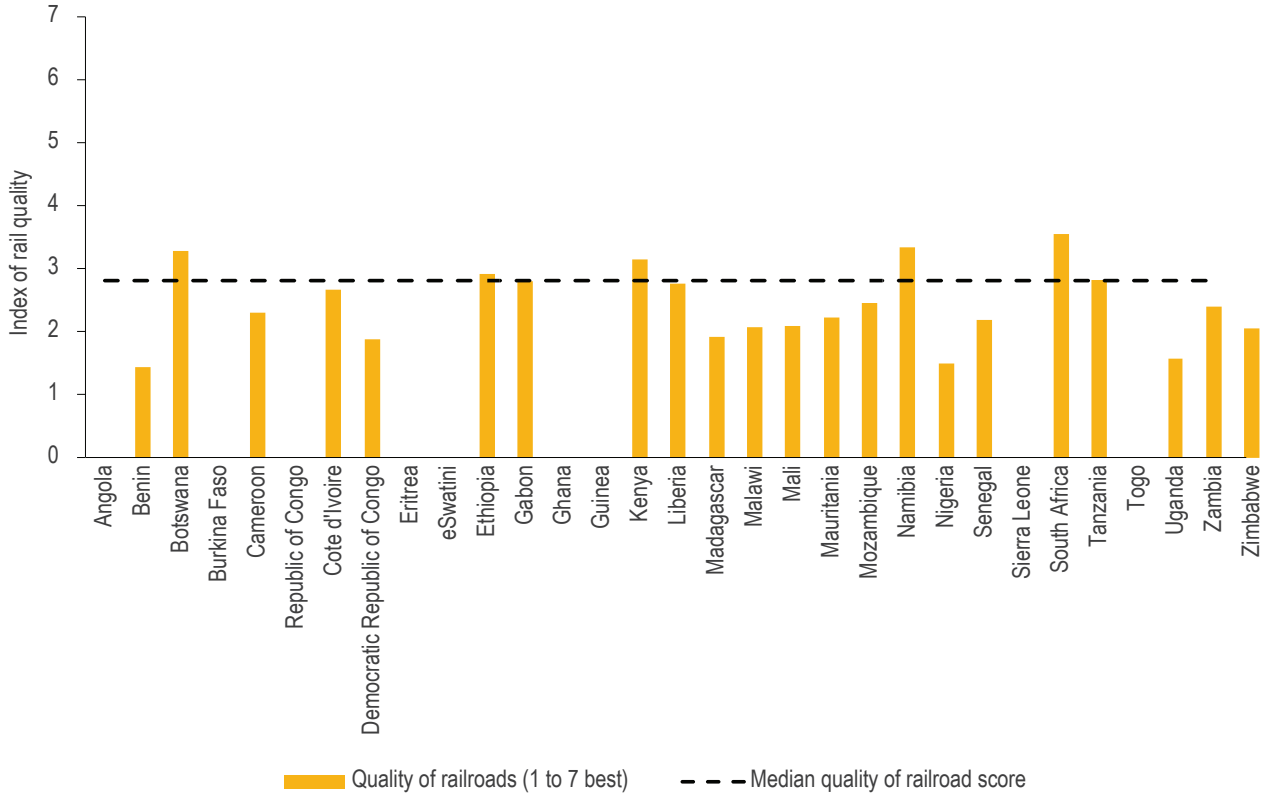
Quality of service

It is difficult to find an indicator of quality of service applicable across all railways. If the public is surveyed, their response will inevitably be in terms of passenger service, and this will also be the case with many businesses in the service sector. Manufacturers will consider the quality of the general freight service, either domestically or, more broadly, the handling of import/export shipments. Manufacturers will be primarily concerned with speed and reliability of service, damage, and cargo security. Shippers of bulk traffic will also weight cost as an important factor.

The indicator adopted for this study is the World Economic Forum (WEF) survey on the quality of railroad infrastructure for 2017 and 2018.[8] The quality of railway service covers a wide range of activities and, because the assessments are done by local businesses, they offer no guarantee of consistency in the scores, although the order of magnitude provides a general guide (see figure 8.8).

To provide some context for these indexes, the Unites States scores 5.48, Germany 5.5, Japan 6.58, and Australia 4.07.

Figure 8.8. Railways Indexes of Rail Quality in Sub-Saharan Africa, 2017–2018



Source: WEF 2017.

Notes

1. This chapter is an abridged version of Lawrence and Bullock (2020).
2. A detailed review of the concessions operating in 2005 is given in Bullock (2005) and Pozzo di Borgo (2006).
3. All figure graphs in this chapter, with the exception of figure 8.8, include data for TAZARA, a railway jointly owned by Tanzania and Zambia. The data for Tanzania represents the Tanzania Railway Corporation and Brazzaville for Congo.
4. Interoperability has not been a significant issue because few places have two gauges in the same location. This could become more of an issue as new standard-gauge lines are constructed.
5. Other than the special case of the Democratic Republic of Congo.
6. The traffic units carried by a railway equal the sum of the passenger-kilometers and net ton-kilometers. Although it has some limitations as an indicator, for example, a first-class passenger-kilometer in a train à grande vitesse (TGV) is treated identically with a passenger-kilometer in a crowded suburban train; it is a widely used, simple standard measure.
7. Data are mostly from 2018.
8. The Quality of Railroad Infrastructure indicator is one of the components of the Global Competitiveness Index published annually by the World Economic Forum (WEF). It represents an assessment of the quality of the railroad system in a given country based on data from the WEF Executive Opinion Survey, a long-running and extensive survey tapping the opinions of more than 14,000 business leaders in 144 countries. The score for railroad infrastructure quality is based on only one question. The respondents are asked to rate the railroads in their country of operation on a scale from 1 (underdeveloped) to 7 (extensive and efficient by international standards). The individual responses are aggregated to produce a country score.

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Appendices

Appendix A: Developing Country Railway Database

Country	Data Year	Length of railway in route-kilometers (operational)					Length of electrified railway (route-km)	Number of locomotives	Number of multiple units	Number of passenger cars	Number of freight wagons	Volume of freight, in tons (thousands)
		1,676/1,520	1,435	1,067	1,000/760	Total						
LATIN AMERICA												
Argentina	2018	11,473	1,486	—	4,897	17,856	0	345	—	—	15,649	18,835
Argentina (suburban)	2018	805	26	—	120	951	257	142	1,130	803	—	—
Bolivia	2018	—	—	—	3,087	3,087	0	49	8	15	2,223	3,349
Brazil (non-urban)	2018	6,208	—	—	21,739	27,947	—	3,630	0	95	113,394	240,571
Brazil (suburban)	2018	698	—	—	170	868	654	45	2,492	43	—	329,678
Chile	2018	2,200	—	40	940	3,180	1,693	81	59	—	2,387	10,600
Colombia	2018	—	246	—	—	246	0	107	—	—	4,212	47,556
Costa Rica	2018	—	—	120	—	120	0	—	—	—	—	190
Mexico	2018	—	17,360	—	—	17,360	—	1,274	60	38	32,286	128,043
Panama	2018	—	76	—	—	76	0	—	0	—	—	7,000
Peru	2018	—	1,907	—	—	1,907	0	111	38	138	2,242	5,748
Uruguay	2018	—	1,903	—	—	1,903	0	3	7	6	624	519
Venezuela	2018	—	41	—	—	41	—	—	—	—	—	—
Commonwealth of Independent States (CIS)												
Belarus	2018	5,479	—	—	—	5,479	1,228	768	288	1,431	44,633	157,164
Kazakhstan	2018	16,061	—	—	—	16,061	4,238	1,755	70	2,412	132,154	282,941
Kyrgyzstan	2018	424	—	—	—	424	0	26	na	339	1,851	7,256
Moldova	2018	1,149	—	—	—	1,149	0	82	—	322	4,975	4,794
Mongolia	2018	1,810	—	—	—	1,810	0	127	—	276	6,585	25,763
Russia	2018	85,626	—	—	—	85,626	43,851	18,432	4,109	17,898	1,170,409	1,415,344
Tajikistan	2018	620	—	—	—	620	0	42	—	424	2,165	5,438
Turkmenistan	2018	3,551	—	—	—	3,551	0	199	—	425	10,056	23,697
Ukraine	2018	21,626	—	—	—	21,626	10,268	3,593	1,335	4,323	201,432	322,342
Uzbekistan	2018	4,718	—	—	—	4,718	1,774	271	18	780	26,991	94,790
SOUTH ASIA												
Bangladesh	2018	1,110	—	—	1,846	2,956	0	272	0	1,630	5,299	4,550
India	2018	62,891	—	—	4,524	67,415	34,319	—	—	—	—	1,221,480
Pakistan	2018	7,479	—	—	312	7,791	0	—	—	—	—	—
Sri Lanka	2018	1,465	—	—	—	1,465	0	84	149	825	787	1,840
SOUTH EAST ASIA												
Cambodia		—	—	—	612	612	—	—	—	—	—	—
Indonesia	2018	—	—	5,042	—	5,042	471	435	966	1,809	6,981	45,236
Malaysia	2018	—	—	—	1,677	1,677	615	89	73	160	2,804	9,454
Myanmar	2018	—	—	—	6,110	6,110	0	307	114	750	3,449	1,624
Thailand	2019	—	—	—	4,508	4,508	0	220	226	1,298	4,617	10,590
Vietnam	2018	—	—	—	2,347	2,347	0	267	0	1,008	4,370	5,664
MIDDLE EAST AND CAUCASUS												
Armenia	2018	694	—	—	—	694	127	—	40	1,398	—	2,880
Azerbaijan	2018	2,133	—	—	—	2,133	1,169	137	18	211	13,590	13,954
Georgia	2018	1,443	—	—	—	1,443	1,443	170	25	40	10,095	10,005
Iraq	2018	—	2,272	—	—	2,272	0	42	56	41	700	425

Freight traffic, in ntkm (millions)	Number of passengers (thousands)	Passenger traffic, in pkm (millions)	Passenger rail fare, in US¢/ pkm	Passenger rail fare, in US¢/ pkm (PPP)	Freight rail rate, in US¢/ ntkm	Freight traffic density (million tonnes)	Passenger density (millions)	Combined density (million traffic units)	Staff	Traffic units/staff (thousands)	Quality of railroad infrastructure (1=worst, 7=best) Score with ranking in ()	LPI rating Score with ranking in ()
9,140	3,101	775	2.31	4.6	2.8	0.51	0.04	0.56	7,061	1,404	2.12 (83)	2.89 (61)
—	424,183	9,132	2.51	5.0	—	—	9.60	—	—	—	—	—
1,887	117	26	1.91	5.1	4.1	0.61	0.01	0.62	1,083	1,766	—	2.36 (131)
153,791	1,405	494	2.33	3.6	3.4	14.58	0.66	15.24	22,124	6,974	2.02 (88)	2.99 (56)
253,709	901,662	18,033	1.64	2.5	—	—	—	—	12,355	1,460	—	—
1,558	47,635	1,006	6.93	9.1	8.0	0.49	0.32	0.81	2,018	1,270	2.47 (74)	3.32 (34)
12,792	658	33	—	—	—	52.00	0.13	52.13	—	—	1.53 (96)	2.94 (58)
15	3,187	48	1.94	3.0	—	0.13	0.40	0.53	53	1,189	—	—
87,959	57,756	1,600	5.20	9.7	3.6	5.07	0.09	5.16	15,650	5,723	2.84 (65)	3.05 (51)
534	65	5	30.00	60.0	—	7.03	0.07	7.09	200	2,695	4.46 (24)	—
1,160	2,992	150	9.74	17.1	—	0.61	0.08	0.69	—	—	2.03 (87)	2.69 (83)
79	247	9	5.53	6.5	7.0	0.04	0.005	0.05	568	155	1.25 (100)	2.69 (85)
21	12,000	246	—	—	—	—	6.00	—	—	—	—	—
52,574	79,857	6,215	2.80	9.0	2.6	9.60	1.13	10.73	61,665	953	—	2.57 (103)
219,927	22,994	19,110	1.61	4.3	1.1	13.69	1.19	14.88	106,534	2,244	4.14 (32)	2.81 (71)
949	326	35	0.01	1.9	—	2.24	0.08	2.32	4,300	229	2.45 (76)	2.55 (108)
970	1,387	77	0.65	1.7	4.7	0.84	0.07	0.91	6,343	165	2.74 (71)	2.46 (116)
15,315	2,572	994	0.63	1.7	1.3	8.46	0.55	9.01	10,808	1,509	2.80 (69)	2.37 (130)
2,596,880	1,157,213	129,365	3.941	9.8	0.8	30.33	1.51	31.84	554,935	4,913	4.55 (23)	2.76 (75)
224	545	33	—	—	—	0.36	0.05	0.41	4,533	57	3.74 (41)	2.34 (134)
12,630	5,263	2,289	0.26	—	2.2	3.56	0.64	4.20	18,701	798	—	2.41 (126)
186,344	151,163	28,615	1.16	4.2	1.3	8.62	1.32	9.94	216,682	992	3.94 (37)	2.83 (66)
22,942	22,623	4,329	1.03	5.5	2.4	4.86	0.92	5.78	55,102	495	—	2.58 (99)
1,237	90,057	12,994	0.80	2.2	2.8	0.42	4.40	4.81	40,275	353	2.94 (60)	2.58 (100)
738,523	8,439,000	1,157,174	0.64	2.2	2.4	10.95	17.16	28.12	1,227,000	1,545	4.36 (28)	—
8,080	55,000	24,904	0.87	3.1	1.9	1.04	3.20	4.23	72,708	454	3.33 (52)	—
120	137,520	7,710	0.47	1.4	—	0.08	5.26	5.34	14,885	526	3.2 (55)	2.6 (94)
—	—	—	2.40	6.5	—	—	—	—	—	—	—	—
15,091	423,846	28,180	2.07	5.8	2.9	2.99	5.59	8.58	28,922	1,496	4.23 (30)	3.15 (46)
1,635	39,538	2,317	3.67	8.7	1.9	0.97	1.38	2.36	5,700	693	5.02 (14)	3.22 (41)
639	46,000	3,894	1.08	3.8	2.0	0.10	0.64	0.74	20,000	227	1.79 (96)*	2.3 (137)
2,716	36,582	5,980	2.29	5.6	—	0.60	1.33	1.93	26,000	334	2.64 (72)*	—
3,990	8,687	3,542	3.14	9.0	1.3	1.70	1.51	3.21	24,459	308	2.96 (59)	3.27 (39)
732	400	60	3.10	8.9	4.4	1.05	0.09	1.14	3,000	264	2.85 (64)	2.61 (92)
4,492	2,833	468	0.59	2.1	2.1	2.11	0.22	2.33	19,760	251	4.69 (20)	na
2,571	2,851	634	1.70	4.6	5.6	1.78	0.44	2.22	12,659	253	3.84 (39)	2.44 (119)
195	457	164	2.08	4.5	2.2	0.09	0.07	0.16	4,238	85	—	—

Country	Data Year	Length of railway in route-kilometers (operational)					Length of electrified railway (route-km)	Number of locomotives	Number of multiple units	Number of passenger cars	Number of freight wagons	Volume of freight, in tons (thousands)
		1,676/1,520	1,435	1,067	1,000/760	Total						
Iran	2018	—	6,153	—	—	6,153	0	928	na	2,093	0	50,321
Israel	2018	—	1,384	—	—	1,384	0	213	110	651	869	8,404
Saudi Arabia (SAR only)	2018	—	2,939	—	—	2,939	10	61	10	62	2,042	—
Turkey	2018	—	12,740	—	—	12,740	5,467	552	203	684	15,645	28,734
UAE	2019	—	261	—	—	261	0	7	0	0	240	6,710
SUB SAHARAN AFRICA												
Angola (CFL & CFB only)	2018	—	—	2692.5	—	2,693	0	—	—	—	—	159
Benin	2019	—	—	—	438	438	0	—	—	—	—	150
Botswana	2018	—	—	886	—	886	0	34	—	—	1,164	1,549
Cameroon	2018	—	—	—	983	983	0	36	0	103	1,012	1,404
Republic of Congo	2018	—	—	795	—	795	0	—	—	—	—	—
Cote d'Ivoire/Burkino Faso (Sitarail)	2018	—	—	—	1260	1,260	0	—	—	—	—	937
Dem. Rep. Congo (NCC only)	2017	—	—	3641	—	3,641	858	53	0	216	1,122	415
Eritrea	2019	—	—	—	115	115	0	—	—	—	—	—
eSwatini	2018	—	—	301	—	301	0	6	—	3	535	7,613
Ethiopia - Djibouti	2018	—	756	—	—	756	756	41	0	30	440	886
Gabon	2019	—	648	—	—	648	0	34	0	30	536	7,137
Ghana	2018	—	—	66	—	66	0	—	—	—	—	708
Guinea	2018	—	239	—	144	383	0	5	0	22	0	14,123
Kenya	2018	—	472	—	2778	3,250	0	—	—	—	—	1,777
Liberia	2019	—	241	—	—	241	0	—	—	—	—	4,595
Madagascar	2018	—	—	—	712.31	712	0	17	0	0	205	92
Malawi (CEAR only)	2017	—	—	733	—	733	0	12	0	0	798	350
Mauritania	2014	—	728	—	—	728	0	—	—	—	—	13,000
Mozambique	2018	—	—	2878	—	2,878	0	—	—	—	—	23,712
Namibia	2019	—	—	2687	—	2,687	0	—	—	—	—	1,551
Nigeria	2018	—	227	3505	—	3,732	0	—	—	—	—	329
Senegal - Mali (Dakar - Bamako)	2017	—	—	—	1288	1,288	0	9	0	0	386	45
Sierra Leone	2019	—	—	200	—	200	0	—	—	—	—	57
South Africa	2018	—	80	23139	—	23,219	9864	—	—	—	—	266,310
Sudan	2019	—	—	2500	—	2,500	0	109	4	60	3,414	450
Tanzania (TRC)	2019	—	—	—	2707	2,707	0	51	0	134	967	154
TAZARA	2019	—	—	1860	—	1,860	0	—	0	144	2,324	176
Togo	2019	—	—	—	82	82	0	—	—	—	—	—
Uganda	2017	—	—	—	314	314	0	—	—	—	—	197
Zambia	2018	—	—	1248	—	1,248	0	40	0	65	1,811	871
Zimbabwe	2018	—	—	2583	—	2,583	0	158	0	295	7,150	3,433
NORTH AFRICA												
Algeria	2019/ 2018	—	3856	—	164	4,020	468	88	268	—	10,213	3,900
Egypt	2019	—	5,153	—	—	5,153	0	528	0	2,541	5,102	5,000
Morocco	2019/ 2018	—	2295	—	—	2,295	1473	132	0	651	4,600	24,800
Tunisia	2018	—	471	—	1306	1,777	90	138	60	115	3,515	3,100

Source: All data collected from various public sources for each country (see appendix B), such as annual railway or regulator reports and/or national statistical a nnuals; most data are for 2018.
Note: Figures in blue are World Bank estimates. ntkm = net ton-kilometer; pkm = passenger-km; PPP = purchasing power parity; route-km = route-kilometer; US¢ = US cent (1/100 of US$1); — = data not available.

Freight traffic, in ntkm (millions)	Number of passengers (thousands)	Passenger traffic, in pkm (millions)	Passenger rail fare, in US¢/ pkm	Passenger rail fare, in US¢/ pkm (PPP)	Freight rail rate, in US¢/ ntkm	Freight traffic density (million tonnes)	Passenger density (millions)	Combined density (million traffic units)	Staff	Traffic units/staff (thousands)	Quality of railroad infrastructure (1=worst, 7=best) Score with ranking in ()	LPI rating Score with ranking in ()
34,859	28,594	15,239	—	—	—	5.67	2.48	8.14	25,209	1,987	3.71 (42)	2.85 (64)
1,235	67,696	3,032	8.10	6.9	4.4	0.89	2.19	3.08	3,786	1,127	3.76 (40)	3.31 (37)
9,781	300	135	8.30	18.0	1.0	3.33	0.05	3.37	1,600	6,198	—	—
12,773	100,568	5,560	1.71	4.3	1.6	1.00	0.44	1.44	18,316	1,001	3.03 (57)	3.15 (47)
1,488	0	0	—	—	—	5.70	0.00	5.70	—	—	—	—
103	2,557	452	0.967	1.942	4.321	0.04	0.17	0.21	2295	242	—	2.05 (159)
66	0	0	—	—	—	0.15	0.00	0.15	—	—	1.43 (99)	2.75 (76)
578	232	41	3.743	7.563	5.188	0.65	0.05	0.70	650	953	3.28 (54)	—
785	691	218	2.862	6.802	7.747	0.80	0.22	1.02	1588	631	2.29(78)	2.6 (95)
—	—	—	—	—	—	—	—	—	—	—	—	2.49 (115)
861	123	991	0.585	1.342	7.152	0.68	0.79	1.47	1514	1,223	—	3.08 (50)
194	—	—	—	—	15.504	0.05	—	—	7193	—	1.87 (92)	2.43 (120)
—	—	—	—	—	—	—	—	—	—	—	—	2.09 (155)
1,751	0	0	—	—	1.237	5.82	—	—	327	5,354	—	—
572	129	98	1.376	3.996	5.253	0.76	0.13	0.89	2703	248	2.92 (61)	—
4,050	322	171	9.198	16.408	2.737	6.25	0.26	6.51	1220	3,460	2.8 (64)	2.16 (150)
45	77	1	4.483	11.155	9.478	0.68	0.01	0.69	1247	36	—	—
—	—	—	—	—	—	—	—	—	—	—	—	2.2 (145)
556	1,394	480	6.020	14.332	2.634	0.17	0.15	0.32	2200	471	3.15 (56)	2.81 (68)
—	0	—	—	—	—	—	—	—	37	—	2.76 (65)	2.23 (143)
29	51	4	1.510	4.931	12.434	0.04	0.01	0.05	658	51	1.91 (90)	2.39 (128)
72	214	30	3.000	8.275	5.200	0.10	0.04	0.14	341	299	2.07 (85)	—
8,775	—	—	—	—	—	12.05	—	—	—	—	2.22 (80)	2.33 (135)
14,227	6,599	2,631	0.041	0.112	1.143	4.94	0.91	5.86	5192	3,247	2.46 (75)	—
664	—	it	—	—	4.904	0.25	—	—	1179	—	3.34 (51)	—
—	3,020	—	—	—	—	—	—	—	—	—	1.5 (97)	2.53 (11)
44	1,896	46	—	—	—	0.03	0.04	0.07	1212	74	2.19 (82)	2.25 (141)
9	0	0	—	—	—	0.04	0.00	0.04	—	—	—	2.08 (156)
152,410	271,531	6,788	2.293	4.542	2.078	6.56	0.29	6.86	26312	6,050	3.55 (47)	3.38 (33)
345	—	—	—	—	—	—	—	—	6678	—	—	2.45 (118)
143	271	204	2.171	6.412	4.114	0.05	0.08	0.13	3000	116	2.81 (68)	—
278	3,046	177	2.240	6.652	4.400	0.15	0.10	0.25	2754	165	2.81 (68)	—
—	0	0	—	—	—	—	—	—	—	—	—	—
39	530	5	2.769	8.189	9.129	0.13	0.02	0.14	540	83	1.56 (95)	2.58 (102)
358	282	102	1.485	3.503	6.300	0.29	0.08	0.37	976	471	2.39 (77)	2.53 (111)
1,078	459	98	—	2.138	6.071	0.42	0.04	0.46	4781	246	2.05 (86)	2.12 (152)
908	34,600	1,454	2.14	6.4	2.0	0.23	0.36	0.59	15300	154	3.42 (49)	2.45 (117)
1,200	263,106	38,378	0.39	1.7	1.6	0.23	7.45	7.68	44,777	884	3.34 (50)	2.82 (67)
3,118	38,300	4,803	3.69	8.1	5.2	1.36	2.09	3.45	7338	1,079	3.90 (38)	2.54 (109)
535	40,000	1,109	1.67	5.7	2.2	0.30	0.62	0.93	4600	357	2.83 (67)	2.57 (105)

Appendix B: List of Main Data Sources

COUNTRY	MAIN DATA SOURCE
LATIN AMERICA	
Argentina	Comisión Nacional de Regulación del Transporte and Ministerio de Transporte. 2018. "Informe Estadístico - Año 2018." Argentina. https://www.argentina.gob.ar/sites/default/files/cargas_2018_1.pdf.
Bolivia	INE (El Instituto Nacional de Estadística). 2018. "Anuario Estadístico 2018." Bolivia. https://www.ine.gob.bo/index.php/publicaciones/anuario-estadistico-2018/. Ferroviaria Oriental. 2018. "Memoria Anual 2018." Bolivia. https://www.fo.com.bo/AcercaDeNosotros/Publicaciones/01.%20Memoria%20Anual/Memoria%20-%20FO%202018.pdf.
Brazil	Revista Ferroviária. 2018. "Anuário RF 2018-2019." Editora Ferroviária Ltda. Brazil. http://www.revistaferroviaria.com.br/.
Chile	Grupo EFE. 2018. "Memoria Anual 2018." Chile. https://www.efe.cl/wp-content/uploads/2020/02/Memoria-Anual-2018.pdf. Metro Valparaíso. 2019. "XXV 2019 Memoria Anual." Chile. https://www.efe.cl/wp-content/uploads/2020/06/Memoria_MV_2019_web_FINAL.pdf.
Colombia	Ministerio de Transporte. 2018. "Transporte En Cifras - Estadísticas 2018." Colombia. https://www.mintransporte.gov.co/documentos/15/estadisticas/.
Costa Rica	INCOFER (Instituto costarricense de ferrocarriles). 2018. "Incofer Informe de Estadisticas Operativas 2018." Costa Rica. http://www.incofer.go.cr/estadisticas/index.htm.
Mexico	Agencia Reguladora del Transporte Ferroviario. 2018. "Anuario Estadístico Ferroviario 2018." Mexico. https://www.gob.mx/artf/acciones-y-programas/anuario-estadistico-ferroviario-2018.
Panama	Georgia Tech Panama. 2019. "Georgia Tech Portal de Logistica En Panama." https://www.infologisticapanama.com/index-1.5.0.html.
Peru	Ministerio de Transportes y Comunicaciones. n.d. "Anuario Estadístico 2018." Peru. https://www.scribd.com/document/458124156/Anuario-Estadistico-2018-Mct.
Uruguay	AFE (Administracion de Ferrocarriles del Estado). 2015. "Memoria Año 2015." Uruguay. https://www.afe.com.uy/wp-content/uploads/MEMORIA-2015.pdf. Association Friends of Latin American Railways. n.d. "News Uruguay." Accessed November 24, 2021. https://www.ferrolatino.ch/en/news/uruguay.
Venezuela	IFE (Instituto de Ferrocarriles del Estado). n.d. "Carriles Del Estado." Accessed November 24, 2021. http://www.ife.gob.ve/Sistema_ferroviario.
CIS COUNTRIES AND MONGOLIA	
Belarus	For all CIS countries data taken from: OSJD (Organisation for Co-Operation Between Railways). 2018. "OSJD Bulletin of Statistical Data on Railway Transport for 2018." Warsaw, Poland. https://en.osjd.org/api/media/resources/c/68/121/462. For Turkmenistan, additional information is taken from: CAREC (Central Asia Regional Economic Cooperation Program). 2021. "Railway Sector Assessment for Turkmenistan—March 2021." https://www.carecprogram.org/uploads/CAREC-CRA-TKM_8th_WEB.pdf.
Kazakhstan	
Kyrgyz Republic	
Moldova	
Mongolia	
Russia	
Tajikistan	
Turkmenistan	
Ukraine	
Uzbekistan	

COUNTRY	MAIN DATA SOURCE
SOUTH ASIA	
Bangladesh	BBS (Bangladesh Bureau of Statistics). 2019. "Statistical Yearbook Bangladesh 2018-2019." Dhaka. http://www.bbs.gov.bd/site/page/29855dc1-f2b4-4dc0-9073-f692361112da/Statistical-Yearbook.
India	Indian Railways. 2019. "Indian Railways Year Book 2018-19." Delhi, India: Government of India, Ministry of Railways. https://indianrailways.gov.in/railwayboard/uploads/directorate/stat_econ/Year_Book/Year%20Book%202018-19-English.pdf.
Pakistan	Ministry of Railways. 2019. "Pakistan Railways Yearbook 2017-2018." Government of Pakistan. https://pakrail.gov.pk/images/yearbook/yearbook2017_18.pdf.
Sri Lanka	Sri Lanka Railways. n.d. "Performance Report 2018." Ministry of Transport, Sri Lanka. https://www.parliament.lk/uploads/documents/paperspresented/performance-report-department-of-srilanka-railway-2018.pdf.
SOUTHEAST ASIA	
Cambodia	Royal Railways. n.d. "Royal Railways (Cambodia)." Accessed November 24, 2021. http://royal-railway.com/?page=front&lg=en.
Indonesia	KAI (PT Kereta Api). 2018. "Laporan Tahunan Annual Report 2018." Indonesia. https://www.kai.id/static/annual-report/annual_report_2018.pdf.
Malaysia	Ministry of Transport. 2018. "Malaysian Transport Statistics 2018." Malaysia. https://www.mot.gov.my/en/Statistik%20Tahunan%20Pengangkutan/Transport%20Statistics%20Malaysia%202018.pdf. KTMB (Keretapi Tanah Melayu Berhad). 2018. "Audited Financial Statement 2018." Malaysia. http://intranet4.ktmb.com.my/ktmb/uploads/files/Finance%20Statement/KTMB_Signed_AFS_2018.pdf.
Myanmar	Statistics provided by Myanmar Railways.
Thailand	State Railway of Thailand. 2019. "Annual Report 2019." Thailand. https://www.railway.co.th/RailwayMiddleFile/PlanIMG/117/132263842142801929_SRT_2019.pdf.
Vietnam	OSJD (Organisation for Co-Operation Between Railways). 2018. "OSJD Bulletin of Statistical Data on Railway Transport for 2018." Warsaw, Poland. https://en.osjd.org/api/media/resources/c/68/121/462.
MIDDLE EAST, CAUCASUS AND TURKEY	
Armenia	Statistical Committee of the Republic of Armenia. 2019. "Statistical Yearbook of Armenia 2019: Transport and Communication." Armenia. https://armstat.am/file/doc/99516803.pdf.
Azerbaijan	OSJD (Organisation for Co-Operation Between Railways). 2018. "OSJD Bulletin of Statistical Data on Railway Transport for 2018." Warsaw, Poland. https://en.osjd.org/api/media/resources/c/68/121/462.
Georgia	Georgian Railway. 2018. "Annual Report 2018." Georgia. http://cdn2.grmedia.com.ge/app/uploads/2019/05/annual_2018.pdf.
Iran, Islamic Rep.	OSJD (Organisation for Co-Operation Between Railways). 2018. "OSJD Bulletin of Statistical Data on Railway Transport for 2018." Warsaw, Poland. https://en.osjd.org/api/media/resources/c/68/121/462.
Iraq	Statistics provided by Iraq Railways.
Israel	Central Bureau of Statistics. 2019. "Transport Statistics Quarterly - Number 4, 2019." Israel. https://www.cbs.gov.il/en/publications/pages/2019/transport-statistics-quarterly-number-4,-2019.aspx.

COUNTRY	MAIN DATA SOURCE
Turkey	Turkish State Railways. 2018. "Annual Statistics 2018." Turkey: Ministry of Transport and Infrastructure. https://www.tcddtasimacilik.gov.tr/uploads/images/Strateji/TCDD-T-2018-istatistik-yilligi.pdf.
Saudi Arabia	Ministry of Transportation. 2021. "National Transport Logistic Strategy (NTLS) 2030." Saudi Arabia.
United Arab Emirates	Etihad Rail. 2019. "Annual Report—2019." United Arab Emirates.
SUB- SAHARAN AFRICA	
For all data sources for Sub-Saharan Africa countries, refer to: Lawrence, Martha, and Richard Bullock. 2020. "Modern Railway Services in Africa: Building Traffic—Building Value." World Bank, Washington, DC. https://openknowledge.worldbank.org/handle/10986/34576.	
NORTH AFRICA	
Algeria	ONS (National Statistics Office). 2017. Statistical Yearbook of Algeria, N° 35. "Chapter XIV: Transport." Algeria: ONS. https://www.ons.dz/IMG/pdf/transports_2017.pdf. Statistics provided by Société Nationale des Transports Ferroviaires (SNTF).
Egypt	Statistics provided by Egyptian National Railways (ENR).
Morocco	ONCF (Office National des Chemins de Fer). 2020. "Rapport Financier 2019." Morocco: ONCF. https://www.oncf.ma/fr/content/download/59782/1375531/file/ONCF%20Rapport%20Financier%202019.pdf.
Tunisia	Statistics provided by Société Nationale des Chemins de Fer Tunisiens (SNCFT).

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